FEB 23 1933

*Annual Meeting, Saint John, N.B., June 20, 21 and 22, 1933*

**Volume XXIV, No. 2** **FEBRUARY, 1933**

# Canadian Public Health Journal

Medical Library

Devoted to the Practice of

**PREVENTIVE MEDICINE**

**DIARRHOEA AND ENTERITIS**
N. E. McKINNON

**ACUTE INTESTINAL INTOXICATION**
ALAN BROWN

**THE MEDICAL CERTIFICATE OF DEATH**
E. S. MACPHAIL

**SKIN SENSITIVITY TO VACCINE VIRUS**
JAMES CRAIGIE and F. O. WISHART

**THOMAS SYDENHAM AS EPIDEMIOLOGIST**
ASBURY SOMERVILLE

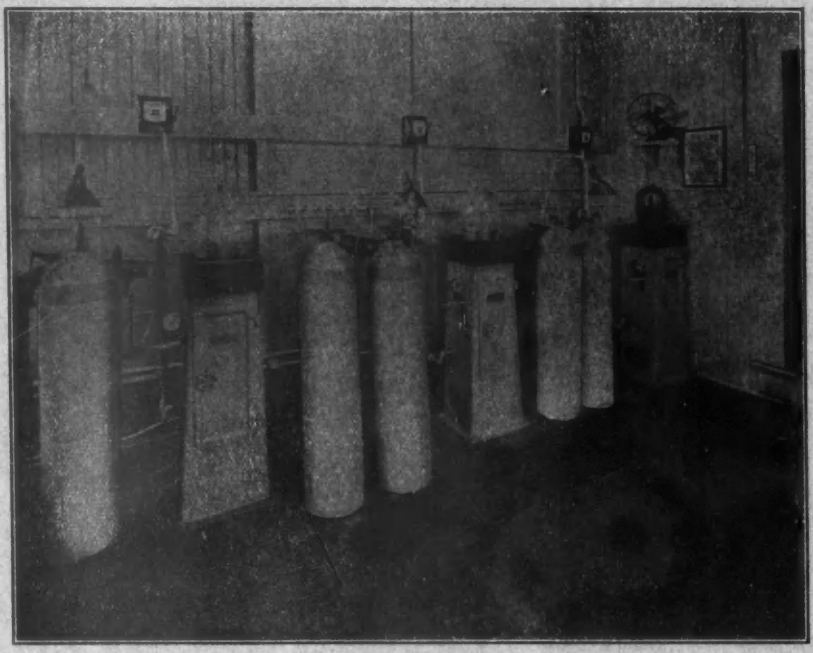
**STERILIZATION OF EATING UTENSILS**
R. St. J. MACDONALD and GRACE M. FREEBORN

*Published by the*

**CANADIAN PUBLIC HEALTH ASSOCIATION**

*Editorial and Business Offices:*

105 BOND STREET, TORONTO 2



Three W & T Vacuum Chlorinators installed at the John St. Pumping Station, Toronto

*Duplicate Toronto's Satisfaction with*

# VACUUM CHLORINATORS

"Standards of purity aimed at in Toronto are the highest in the world . . . 95.3% of all the samples of water examined (over a year's period) gave negative tests in 100 cc. of water, the accepted American Public Health standards being a negative test in 10 cc."

(*Contract Record news item, Vol. 45, No. 37*)

Twenty W&T Vacuum Chlorinators help maintain this high standard at Toronto. Install Vacuum Chlorinators and Toronto's experience can be yours too. Technical Publication 38—your copy free—will tell you why.

*"The Only Safe Water is a Sterilized Water"*

## WALLACE & TIERNAN, LTD.

*Manufacturers of Chlorine and Ammonia Control Apparatus*

345 Sorauren Ave., TORONTO, ONTARIO

301 Bank of Hamilton Bldg., WINNIPEG, MAN. 218 New Birks Bldg., MONTREAL, P.Q.

CANADIAN PUBLIC HEALTH JOURNAL

VOL. XXIV February, 1933 No. 2

# Problem of Diarrhoea and Enteritis, Under Two Years of Age*

N. E. McKINNON, M.B.

*Department of Epidemiology and Biometrics, School of Hygiene, University of Toronto*

THE public health aspects of diarrhoea and enteritis under two years of age are, first, the extent of the problem, and second, the possible means of control.

*The Extent of the Problem*

Approximately 700 deaths of children under two years of age are tabulated in official mortality records under diarrhoea and enteritis every year in the province of Ontario. The mortality rate is 8.8 per 1,000 in the first year of life and 5.4 for the first two years. Forty to sixty deaths, or over 5 per cent of the deaths from diarrhoea and enteritis, occur in the first month of life, the period in which 50 per cent of infant mortality occurs and in which the deaths attributed to prematurity, congenital debility, etc., greatly outnumber, according to present evidence, those due to all other conditions. It is after the first month has passed that the deaths from diarrhoea and enteritis show in such serious proportions.

Diarrhoea and enteritis was the first cause of death from the second to the twelfth month of life in Ontario, 1925-1929. It was the second cause of death in the second year of life. Diarrhoea and enteritis accounted for approximately 1 in 4 of all deaths from the second to the twelfth months, 1 in 3 of all deaths from the fourth to the ninth month, and 1 in every 7, or 14 per cent, of the deaths in the second year of life.

In the same period, 1925-1929, in Ontario, the number of deaths from diarrhoea and enteritis was more than twice that from diphtheria, more than three times the number from whooping cough and six to seven times the number from measles or scarlet fever. Even these data fail to tell the whole story. Diarrhoea and enteritis means gastro-intestinal infection, and all gastro-intestinal infections should be grouped

*Presented at the 21st Annual Meeting, Canadian Public Health Association, Toronto, May, 1932.

together for the purpose of control. The investigations in the Hospital for Sick Children[1] have shown that in such diagnoses as acute intestinal intoxication, cholera infantum, infectious diarrhoea, fermentative diarrhoea, summer diarrhoea, etc., gastro-intestinal infection is the factor of primary importance; and that cases finally proven to be gastro-intestinal infections had been first diagnosed under terms which did not suggest the actual condition. There should be added, therefore, to the

TABLE I

ONTARIO

1925-1929 (five-year average)

SIX CAUSES OF DEATH—2ND TO 12TH MONTH

| | |
|---|---|
| 1. Diarrhoea and Dysentery | 566 |
| 2. Pneumonia and Bronchitis | 501 |
| 3. Congenital Debility | 160 |
| 4. Congenital Malformations | 140 |
| 5. Whooping Cough | 126 |
| 6. Influenza | 99 |
| | 1,592 |

TABLE II

DIARRHOEA, ENTERITIS AND DYSENTERY, UNDER ONE YEAR

Ontario, 1925-1929

| Age Period | Per cent of all Deaths | Proportion* of all Deaths |
|---|---|---|
| 2nd and 3rd months | 17% | 1 in 6 |
| 4th to 9th month | 29% | 1 in 3 |
| 10th to 12 month | 22% | 1 in 5 |
| 2nd to 12th month | 25% | 1 in 4 |
| 2nd year | 14% | 1 in 7 |

data already submitted, an unknown number attributed wrongly to other diagnoses, a significant number of deaths attributed to convulsions, but due in some cases to gastro-intestinal infections, and, it would appear, a number attributed to intestinal influenza. The seasonal distribution of deaths attributed to intestinal influenza so closely coincides with that of diarrhoea and enteritis that there can be little doubt that the causative agent of so-called intestinal influenza is not related in any way to the causative agent of influenza, but is one or more of the *common* gastro-intestinal infections, established and recognized

*Approximately.

as such. Such deaths are now tabulated under influenza and do not appear under diarrhoea and enteritis.* And, as part of the extent of the problem, there must be added the volume of sickness due to the same causes; the amount of such sickness is too well indicated by the mortality data to need further comment.

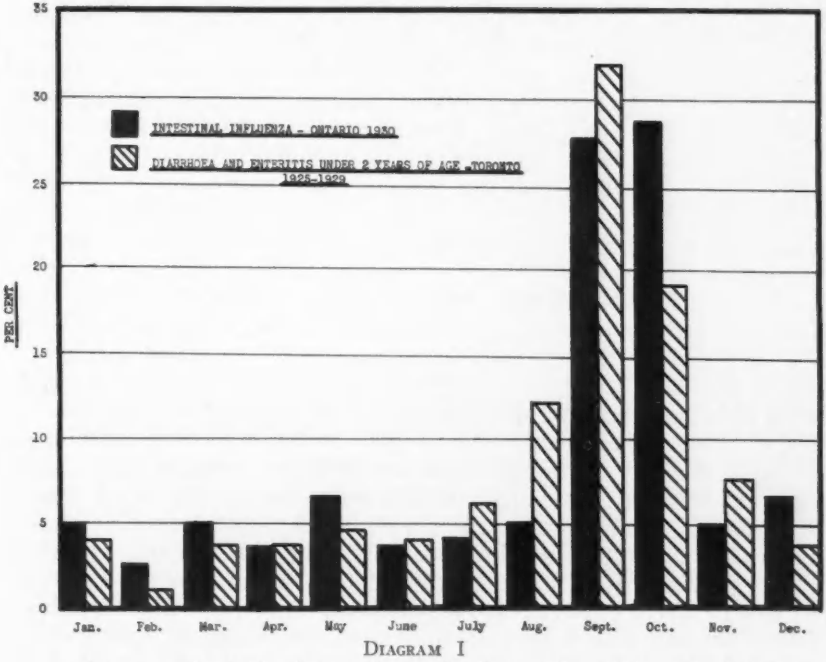



DIAGRAM I

Percentage distribution by months of diarrhoea and enteritis under 2 years of age in Toronto, 1925-29, and "intestinal influenza" in Ontario, 1930.

*The Control*

As the case fatality in cases hospitalized under the best of conditions may reach 50 per cent,[1] it is evident that adequate control of this problem through any form of treatment of the case is quite out of the question. If much is to be accomplished in diarrhoea and enteritis, it must be through prevention rather than cure. The only control is its prevention.

Control requires first a realization of the cause—and the cause is, as stated, gastro-intestinal infection. The source of the infection is the gastro-intestinal tract of man, and possibly, though of less importance, of lower animals. There is nothing mysterious in the means by which the infection reaches the infant. The organisms can neither fly nor sail

* These deaths will in future be sub-classified under *Influenza, intestinal,* in the Vital Statistics of Canada."[2]

through the air; they cannot jump; neither can they crawl. They reach the infant by someone or something contaminating its food or drink with excreta—excreta, in the majority of cases, from the gastro-intestinal tract of other humans, often older members of the family. The problem of control is, therefore, that of preventing the transfer of such excreta to the food of the child.

In 172 cases of gastro-intestinal infection studied at the Hospital for Sick Children, only three were exclusively breast fed. That indicates one means of control; namely, breast feeding. The rationale of such control is that the food is not handled between its source and the baby, and is not, therefore, subject to contamination. Breast feeding is the most effectual means of control during the nursing period of the infant's life. Pasteurization of milk and chlorination of water play an important part in prevention. But, for the safety of the nursing infant and more especially of the bottle-fed infant and the older child, there must be developed a sanitary conscience on the part of the people; a realization on the part of mothers and others, including nurses, of the sources of infection that exist, unsuspected, among mankind, among ourselves; of the manner in which the infection is transferred to the infant; and a realization, too, of the results of such transfer. Those attending children must learn how the spread of such infection may be eliminated by higher standards of cleanliness and common decency, to say nothing of personal hygiene. A not unimportant factor is suggested in the seasonal incidence of the deaths from diarrhoea and enteritis as shown in Diagram I. This shows that 63 per cent of the deaths occur in August, September and October—the peak coinciding with the greatest prevalence of flies. In the studies carried out at the Hospital for Sick Children,[1] already referred to, it was found that the families in which cases occurred were largely of the poorer class living in surroundings heavily infested with flies. When flies were caught in homes from which cases had come, and were subjected to bacteriological investigation, the same type of organism was isolated from the gastro-intestinal tract of the flies as was found responsible for the condition in the child. Fly control is, therefore, an essential part of the control of diarrhoea and enteritis.

In the education of the mothers and others attending children, and in moulding a sanitary conscience, without which this problem cannot be adequately solved, no one can play as important a part as the private physician.

REFERENCES

[1]Johnston, Marion M., and Kaake, Mildred J., *Canad. Pub. Health J.*, *23*: 159 (Apr.), 1932.
[2]E. S. Macphail, Chief, Division of Census and Vital Statistics. Personal communication.

# Acute Intestinal Intoxication*

ALAN BROWN, M.B.

*Physician-in-Chief, Hospital for Sick Children, Toronto*

THE first to describe the disease in America was probably Dr. Benjamin Rush; he had noted its prevalence in the Atlantic coast towns and thought that it was peculiar to the American continent. This disease, which is of medical interest in tropical and temperate zones, occurs sporadically during the year, but in Canada and the northern part of the United States it exists in epidemic form during the months of August, September and October. It commences suddenly with diarrhoea and vomiting; frequently diarrhoea begins first, followed by vomiting. In a day or two drowsiness and toxaemia appear, and the disease terminates in death in the majority of the severe cases.

*Etiology*

Many theories have been current as to its etiology. Early observers who were aware of the high death rate in infancy due to this disease were convinced that food played an important role—and radical measures were adopted for its remedy. When Pasteur and his contemporaries and successors emphasized the importance of bacteria as causes of disease, a new field of investigation was opened. Various surveys have been conducted in America during the past thirty years. Wollstein, Duval and Bassett discovered the dysentery bacilli in a series of cases of infantile diarrhoea and thought that the cause of this disease was found. Booker, however, stated that no single organism was found to be the specific exciter of summer diarrhoeas. Weaver, Tunnicliffe, *et al.*, who were searching for dysentery bacilli in summer diarrhoeas, concluded that "however the case may be in epidemic dysentery in children, it looks as if we should be obliged for the present to say we are unacquainted with a specific cause for all cases of summer diarrhoea in infants, but that it is likely that many cases are due to the single or combined action of various forms of bacteria." Graham, in the Hospital for Sick Children, Toronto, found dysentery bacilli, as did also Ten Broeck and Norbury. Kendall thought the gas bacillus, B. welchii, was the etiological factor, and streptococci have been also incriminated.

*Suggested Relationship of Otitis Media*

Another school of thought arose with the revival of an idea promulgated in Europe by Renaud. In 1898, Hartmann suggested a causal relationship between severe gastro-intestinal disturbances and otitis media. Preysing, in 1904, stated that he believed these severe

*Presented at the 21st Annual Meeting, Canadian Public Health Association, Toronto, May, 1932.

intestinal disturbances were due to toxic substances which had found their way into the blood or lymph currents owing to rapid absorption from the middle ear empyema. Byfield, in Abt's Pediatrics, called attention to gastro-intestinal symptoms in children which are the direct result of obscure infection in the middle ear or mastoid. Floyd, Alder, Lyman, Marriott, Jeans, and others believed that this theory was of importance and attributed gastro-intestinal disturbances in infants to streptococcus infections in the ears. It was suggested that streptococcus toxin exerted a specific action on the capillaries of the body in general and of the intestinal tract in particular, resulting in the hydrolability which is so characteristic. Jeans and Floyd found cases in which a syndrome comparable to alimentary intoxication was present, but which at autopsy showed no evidence of infection other than in the mastoid antra. They did not assert that mastoid infections were the sole cause of the clinical symptoms, but their cases improved when drainage of the mastoid was instituted.

Sidbury found that ear involvement nearly always accompanied acute intoxication, either primarily, or, later, as the result of infection due to lowered resistance. The infecting organisms were streptococci in the larger number of cases. MacNeil found that there was middle ear and mastoid infection in cases which had symptoms of acute intoxication. Sutton reported a case of enterocolitis and mastoiditis in which the symptoms were gastro-intestinal and the examination of the ear on admission showed no complication. At autopsy ear involvement was seen to have set in. The cultures which were taken yielded streptococcus and *B. morgani*, which latter organism was obtained from the heart's blood after death. It was considered that in this case the ear condition was secondary to the intestinal condition. Spahr stated that in infants cultures from middle ears are valueless as indications of the causative organism of an accompanying mastoiditis. Infants with otitis media and diarrhoea, vomiting and loss of weight, often have infected mastoid antra. When *B. coli communior* or *B. morgani* were found in the mastoid antra, diarrhoea and vomiting were noted. Other organisms such as pneumococcus, streptococcus, or staphylococcus were found in the mastoid cultures. It was not held that they gave rise to the characteristic symptoms in the infants. O'Donnell and Myers aspirated material from otitis media through the drums and found a variety of organisms. The cases were not patients suffering with intestinal intoxication, so that otitis media is not peculiar to intestinal disturbances of that type.

Dick, Dick, and Williams studied a series of cases of sudden onset with diarrhoea, vomiting, loss of weight and fever, in which the mortality was 30 per cent. Surgical treatment of mastoiditis did not help the disease when compared with similar cases where mastoid or drum drainage was not instituted. Comparison of sick and well children showed no significant difference in nose and throat cultures. A patho-

logical study showed intestinal inflammation in 25 of 27 fatal cases. The earlier in the course of the disease that death occurred, the more marked were the indications of acute enteritis, as the intestinal mucosa showed haemorrhage and the Peyer's patches were swollen. They isolated Morgan's bacillus, B. proteus asiaticus and B. eberthella pyogenes from the stool cultures. D. T. Smith suggested that poor physical condition, due to artificial feeding, to poor hygiene and generally lowered, resistance predisposed to middle ear complications, which probably proceed from the nasopharynx. In a bacteriological study of middle ear infection, Valentine found that the streptococci isolated from the ear discharge and believed to be the pathological exciting factor, were bacteriologically and serologically identical with strains isolated from the throat. If the infection was bilateral in some cases, the primary infection was due to the same strain as was secured from the throat. Fisher experimentally irritated the nasal mucous membrane of rabbits and introduced upon the sensitive membrane cultures derived from the middle ear infections of human beings. The rabbits died, and in each case acute purulent sinusitis and acute otitis media were found to have been produced, the infection having set in when the resistance of the tissues was diminished. The cultures isolated at autopsy were similar to that which was used for inoculation in each instance.

*Bacteriological Findings*

The wide variety of micro-organisms which have been held to be responsible for the disease has been increased by Fothergill, who described a "late-lactose fermenting" micro-organism which apparently possessed invasive qualities, demonstrated by the presence of agglutinins produced in the patient's serum against this bacillus. The cultures were obtained from the stools of the patients suffering with acute diarrhoea.

In the late summer of 1927, Brokman and Kolago, in Warsaw, described an epidemic among infants under two years of age. They described a symptom-complex similar to that seen in this clinic. The initial symptoms were vomiting and diarrhoea, which did not occasion any alarm, and the acute stage arrived never later than a few days afterwards. Fever increased, vomiting set in violently, with, in some cases, almost total cessation of diarrhoea. Loss of weight due to dehydration, drowsiness, and loss of tissue turgor were also noted. Stools manifested mucus and some blood, so that from the bacteriological standpoint their clinical symptoms pointed to dysentery or paratyphoid infections. There was some resemblance to paratyphoid fever, but their patients were more acutely ill than those usually suffering from paratyphoid infections, and the mortality rate (100 per cent in the age group over one year) was higher than that of a typhoid fever. The possibility of bacteria normally present in the intestine passing into the

blood was offered, but this idea was discounted, since the micro-organisms isolated were not normal inhabitants of the intestine. Moreover, bacteraemia was not always a cardinal symptom in all fatal cases. Again, if these bacteria were in the intestine and dyspepsia or some other factor could so alter the intestinal resistance as to permit their passage into the blood, these bacteria would frequently appear in the faeces, but this was not the case. They succeeded in obtaining 11 positive blood cultures; 4 identified as B. paracoli; 2 B. paratyphosus C; 1 B. paratyphosus A; 2 of undetermined species, but closely related to B. paratyphosus B, or C, or B. aertrycke; 2 B. dysenteriae of the Flexner type, but serologically distinct from it. Therefore, their results clearly pointed to a clinical syndrome due to a wide variety of bacterial species, which, however, are related.

### CLINICAL PICTURE

Acute intestinal intoxication, sometimes designated as cholera infantum or acute fermentative diarrhoea, is a distinct clinical entity. The condition is characterized by three cardinal signs and symptoms; namely, diarrhoea, vomiting and drowsiness. The disease occurs chiefly in infants from two to twelve months of age, although occasionally it is seen during the second year of life and even later. It is encountered sporadically throughout the year, but in Canada and the northern part of the United States it occurs in epidemic form during the months of August, September and October.

The history usually obtained is that the illness starts with diarrhoea. In some instances the diarrhoea is followed in 24 to 48 hours by drowsiness. The vomiting occurs two to ten times a day. The stools, which are five to ten a day, are loose and watery and sometimes contain mucus, but not the pus and blood seen so frequently in dysentery. The degree of drowsiness varies even in the same infant. In the mild and moderately severe cases the infant may appear quite bright when aroused. Even the disturbance produced by undressing the infant may be sufficient to dispel any evidences of drowsiness. For this reason the patient should be carefully observed before being disturbed in any way. When roused the infant has a shrill, piercing cry, although in the severe cases the cry may be only a weak moan. The temperature rarely exceeds 102 or 103°F. The colour of the skin is ashen gray, the eyes are sunken, the hands and feet are cold and clammy and either cyanosed or gray in colour. Dehydration is invariably present, as shown by loss of elasticity of the skin. The liver is usually enlarged. In many instances infections of the upper respiratory tract, including the ears and mastoids, are encountered.

The condition occurs not only in the under-nourished marantic infant with a history of previous gastro-intestinal disturbances, but likewise in infants of normal weight with no history of previous trouble. It is a disease chiefly of the free dispensary class, being rarely encoun-

tered in well-to-do families, although we have seen an occasional case in this latter group.

The course of the disease may be very rapid, some infants dying within 24 to 48 hours of the onset of drowsiness in spite of any treatment employed. In other cases the drowsiness disappears and the vomiting ceases within 24 hours of the institution of treatment and the infants make an uneventful and usually rapid recovery. The remaining patients continue to vomit slightly and are drowsy for many days before they make the turn one way or the other. The mortality in the severe cases is very high, being well over 50 per cent. This is irrespective of the previous nutrition of the infant. In fact, the large, rather fat infant frequently shows the least resistance to the disease.

## FUNDAMENTAL CONSIDERATIONS IN TREATMENT

To date there is no specific therapy, the treatment being entirely symptomatic. The symptoms to be combated are diarrhoea and vomiting, which quickly produce a severe dehydration and change of the acid base content of the body. The absorption of toxin from the digestive tract is probably of minor importance.

Before attempting to treat the dehydration the changes in the acid base balance of the blood were studied. Estimations of the sodium chloride and bicarbonate content of blood sera were made, by standard methods, in 22 cases of acute intestinal intoxication at the time of admission to the hospital. In every case studied, except one, there was a lowering of the bicarbonate content of the serum; that is, an acidosis was present. In some cases the acidosis was so marked as to be distinguished clinically by the cherry red colour of the lips, and by the deep rapid respirations. Observation of the breathing should be made when the child is undisturbed, for slight disturbances may markedly alter the character. This precaution is also necessary in estimating the degree of toxicity present.

In acute intestinal intoxication there are two main factors at work which bring about variations in the concentration of the chloride in the blood serum. Loss of hydrochloric acid, through vomiting of gastric secretion, brings about a decreased concentration. Loss of water, through the frequent watery stools, reduces the total volume of serum, and hence tends to increase the concentration of chloride. The interplay of these two modifying factors, one causing a reduction, the other an increase in the chloride concentration, explains the finding of a normal or increased chloride content in some sera.

In all cases of acute intestinal intoxication there is a loss of aklaline intestinal content due to diarrhoea. This results in a decreased concentration of the sodium of the serum, which concentration is modified by the increased concentration of the blood through loss of water.

The amount of bicarbonate in the blood serum is dependent upon the difference between the amount of fixed base, largely sodium, and

the sum of the acids stronger than bicarbonate, this being largely chloride. From the figures obtained on blood serum it was found that the decrease in bicarbonate did not entirely depend upon the changes in sodium and chloride, but was partially due to changes in the unestimated acids and bases, as the concentration of protein, phosphate and sulphate increased through the loss of fluid from the blood.

Thus, taking our observations into consideration, the conditions to be combated in acute intestinal intoxication are the following:—(1) *dehydration*, which is due to loss of water through diarrhoea and vomiting; (2) *acidosis*, which is due to disturbances of the acid base balance brought about by (*a*) loss of bases through diarrhoea and vomiting, (*b*) increased concentration of acids through defective excretion, since the amount of water available for kidney function is lowered, and (*c*) accumulation of acetoacetic and *B*-oxybutyric acids, the result of insufficient metabolism of carbohydrates due to the persistent vomiting of food; (3) *toxaemia*, resulting from dehydration and absorption of toxin from the intestinal tract.

It must be remembered that the total amount of fluid in the body is reduced below normal. This is shown by the inelasticity of the skin, loss of weight and thickness of the blood. Hence, though in some cases the sodium chloride and bicarbonate per cc. of blood serum somewhat approximates the normal amounts, yet, due to the decrease of total amounts of serum in the body, the total amounts of these substances present in the whole body are reduced.

## TREATMENT

In the autumn of 1929 the following routine treatment of acute intestinal intoxication was instituted in the Hospital for Sick Children. A direct transfusion of 15 cc. of whole blood per pound of body weight is given as soon as possible. Subsequent transfusions, as indicated by clinical observation of the degree of toxicity, are given in 24 or more hours later. This measure helps in combating toxaemia, through supplying water, acid and bases in their normal proportions. The administration of large amounts of fluids is necessary, but on account of the vomiting and diarrhoea, routes other than the gastro-intestinal tract have to be used. Subcutaneous administration by gravity is the easiest, and less discomfort is produced in infants and children when the subcutaneous tissue of the abdomen is used instead of the axilla. The fluids injected subcutaneously are 5 per cent glucose solution, normal saline solution, or a combination of 5 per cent glucose and normal saline. Approximately 10 cc. of the selected fluid per pound of body weight is administered one to three times a day, depending upon the rate of absorption. In severe cases where the dehydration cannot be remedied by the subcutaneous route, or if the degree of toxicity is marked, fluids should be given intravenously or intraperitoneally. Fluid is given

intravenously through the longitudinal sinus. The same type of fluid is used as for interstitial injections in the quantity of 15 cc. per pound of body weight. Intraperitoneally, about 20 cc. per pound, of normal or physiological saline solution can be administered at one time. In our experience it is not advisable to give glucose intraperitoneally because of the danger of intestinal distension.

When saline solution is administered to children with normal water content and normal kidney function, the body can retain the acid or basic substances as required and excrete the unwanted materials. In acute intestinal intoxication, in addition to a decreased water content of the body, there is frequently associated damage to the kidney, with a resulting impairment of renal function. Hence, substances administered are apt to be retained in the body in the concentration in which they are administered. Normally, blood serum contains 157 cc. N/10 base and 103 cc. N/10 Cl per 100 cc. serum. In normal saline solution there are 154 cc. N/10 base and 154 cc. N/10 Cl. From these figures it will be seen that when normal saline solution is administered while the base and chloride are both retained in the body in the proportions in which they are administered, the amount of base per 100 cc. of serum will remain unchanged while the chloride will be increased. The extra chloride will bring about a lowering of bicarbonate, thus producing an acidosis.

Through the administration of glucose solution the kidney function is stimulated. The ketosis is combated and calories are supplied. There is also a decrease in the concentration of the blood, but acids and bases lost through diarrhoea and vomiting are not replaced.

It would appear that a combination of glucose and salt solution is most suitable. The glucose solution supplies water to correct dehydration, and for the excretion of unwanted acids and toxic substances, and supplies antiketogenic material and calories. The saline solution supplies the bases and acids which have been lost through vomiting and diarrhoea. Here the best results are obtained when three-quarters of the parenteral fluid is administered in 5 per cent glucose solution, and one-quarter in the form of physiological saline solution. The parenteral administration of fluid is continued until the patient is able to take a normal amount by mouth and the clinical dehydration has disappeared.

During the acute stage of the illness milk feedings are contraindicated because of the poor toleration, *i.e.*, they accentuate the vomiting, diarrhoea and toxaemia. The solutions given by mouth are either a 15 per cent sugar solution, consisting of 7½ per cent glucose and 7½ dextri-maltose, or a solution consisting of 1 part of 1 per cent sodium citrate, orange juice 2 parts, and 10 per cent glucose 3 parts (C.O.G.). This last solution, in addition to supplying water, anti-ketogenic substance and calories, also counteracts acidosis, due to the fact that in the process of digestion the organic acid is destroyed and bicarbonate is formed. The ice cold fluid is given in teaspoonful doses, not more

frequently than every five minutes, with a total of 1 to 2 ounces per hour. If the vomiting is marked, the stomach is lavaged with a solution of sodium bicarbonate, 1 teaspoonful to the pint, a rest period of one to two hours is allowed, and fluid is again started.

When the infant has been free from toxicity for about 48 hours, and vomiting has ceased, or is only occasional, milk feedings are started. These may consist of a mixture of evaporated milk of half the concentration that would be ordinarily used for the patient according to age. An ounce of rice flour may be added. A dilute protein milk, one-third to two-thirds strength, is useful if the diarrhoea has been very severe. The C.O.G. is replaced very gradually by the milk mixture. If vomiting and toxaemia recur the milk feedings are discontinued, and only C.O.G. is given for a further period.

SUMMARY

1. Acute intestinal intoxication, a disease of the autumn months, is characterized by diarrhoea, vomiting and drowsiness.

2. The blood serum in acute intestinal intoxication shows a decrease in bicarbonate; that is, an acidosis. This is due to loss of base through diarrhoea and vomiting, and piling up of acids through failure of excretion. Loss of chloride through vomiting, and a reduced amount of serum through loss of water, modify the acid base concentrations.

3. The routine treatment of acute intestinal intoxication, as carried out in the Hospital for Sick Children, Toronto, is the following: transfusion of whole blood; the administration of fluids parenterally, one-quarter of the amount being administered in the form of normal or physiological saline solution, three-quarters as 5 per cent glucose solution; sodium citrate, orange juice and glucose solution, or 15 per cent sugar solution by mouth until the toxicity has disappeared; then diluted evaporated milk or protein milk formulae.

---

## Public Understanding of Public Health

"WHILE public health is the foundation of the happiness and prosperity of the people, and its promotion is recognized as an important function of government, how wide is the gap between what is achieved and what might be realized; how inadequate is the understanding of the public concerning the means adopted to secure the best results."

—WILLIAM H. WELCH, M.D.

# The Medical Certificate of Death*

E. S. MACPHAIL

*Chief, Division of Census and Vital Statistics,*
*Dominion Bureau of Statistics, Ottawa*

THE present is an appropriate time for the discussion of the certification of causes of death, since the revision of the International List which took place at Paris in October, 1929, has only recently been put into effect by most countries, and any improvement which can be made at the present time and in the near future in the certification of causes of death will add to the value of the improvements made in the International List by this revision, which must undoubtedly be considered as having brought it more in line with modern medical views.

It is not the intention here to discuss the changes brought about by the revision of 1929, as a fairly comprehensive review of the changes made at the Paris meeting was given in a paper[1] read before the Vital Statistics Section of the Canadian Public Health Association at its first meeting in 1930. The Physicians' Pocket Reference, issued in large numbers by the Dominion Bureau of Statistics and placed in the hands of practising physicians through the Provincial Registration Offices, contains the full list of the International Classification, with certain additional sub-divisions made for Canadian use.

In connection with the last revision (1929), several questions intimately connected with the subject of the tabulation of causes of death came up for discussion, both in the preparatory work and in the actual sittings of the Commission. One of these was the matter of uniformity in the questions relating to "cause" on the death certificates. It was recognized that in those countries where only one question, "Cause of death," appeared on the medical certificate, the reply furnished might not contain all the information necessary for adequate classification of a death to its proper rubric in the International List. In those countries which, like the provinces of Canada, ask for the "cause of death" and also the "contributory or secondary cause" as well, together with the duration of each, it was still obvious that the choice of the disease or condition which should be given as the cause of death would not be made in a uniform manner by the physicians certifying, and that a "contributory" cause might in some cases be a condition helping to give rise to the disease causing death or a complication or terminal condition of the disease, and might in other cases have no direct causal relation to the disease to which death was attributed. With a view to overcoming the disadvantages in the classification of causes of death

**Abstract of paper presented at the 21st Annual Meeting of the Canadian Public Health Association, Toronto, May, 1932.*

[1]*Canad. Pub. Health J., 21: 342 (May), 1930.*

arising from the use of medical certificates which were thought to be not sufficiently detailed in their questions, several suggestions were made in the preparatory work for certificate forms of a somewhat more elaborate nature, and which would bring out clearly the distinction in relationship between those causes which were entirely independent and those of which the one was a sequela or complication of the other.

In Canada we have had some correspondence with certain of the provinces regarding possible changes in the medical certificate which would make it incumbent on the certifying physician to show more clearly than is necessary for him to do at present the one of two or more causes to which, in his opinion, death was really due, and to distinguish clearly the series of causes which he considers to have produced death from any co-existing disease or condition which, while not directly causing death, may have had a contributory effect by lowering the decedent's resistance, or in some other fashion. At present the matter lies in abeyance, but we feel that it is one on which the feelings of the provincial departments should be obtained in the near future, with a view to seeing whether some changes should be made in the form of the certificate.

*Contributory Cause of death*

But, although the present certificate with its two questions, "Cause of death" and "Contributory cause" and the duration of each, together with the subsidiary information as to an operation or an autopsy when these have taken place, might certainly be improved by greater elaboration, and while it requires the application of certain rules at the Central Office for the choice of one cause rather than others, it must not be imagined that it takes away from the certifying physician the power of influencing this choice. In the first place, we are utterly dependent upon him for mention of more than one cause. In the second place, it is very unlikely that any rules which might be applied in making a choice of one cause from several mentioned would be used in the face of a definite statement on his part that in a particular case a different choice should be made. By scrupulous care in mentioning all contributory causes, with their duration, and any significant facts which will help to bring out their relationship, the certifying physician can feel reasonably sure that the cause to which any particular death will be assigned is really in accordance with the choice which he has clearly and logically indicated.

The above statement should perhaps be qualified to the following extent. It is often found that the certifying physician gives the proximate cause of death or terminal condition as resulting from some disease which initiated the train of conditions causing death, this primary disease being stated on the certificate as contributory. Where this relationship is clear, the choice for statistical purposes is, generally speaking, the

disease from which the other condition proceeded. The logic of this choice will be obvious.

*Malignancy*

With regard to new growths, it is always important to have a statement as to the malignancy of the growth. The physician may consider under certain circumstances that the malignancy could be taken for granted, but he cannot find fault with a statistical office for trying to obtain a statement on this point wherever possible. For example, the cause of death on a certain certificate was "tumour of the brain"; inquiry revealed cancer. In a second case, the cause of death was "broncho-pneumonia", contributory, "brain tumour"; inquiry disclosed it as non-malignant.

*Incomplete Statement*

The incompleteness of medical certificates is sometimes indicated by the importance of the information bearing on the cause of death which is obtained by subsequent inquiry. To illustrate this point I should like to make use of a few cases from the city of Toronto.

The statistician of the City Health Department sends on to our office the transcripts which his department makes from the death registrations of the city of Toronto, in order that we may compare our system of classification of cause of death. On these transcripts we frequently find that he has obtained additional information regarding the cause of death. The following are instances:—Where the cause of death of a child six months old was given as retropharyngeal abscess, inquiry revealed that it was not due to tuberculosis, but to pneumonia. A death was certified as due to cardiac failure, but on inquiry this failure was found to have followed an operation for gall stones. Again, a medical certificate showed cerebral haemorrhage as the cause of death, but on inquiry the physician stated that the patient had suffered from generalized arteriosclerosis. This death was assigned, therefore, to the latter cause. In two certificates certified to pneumonia, the doctor when asked stated that the disease, in one instance, was lobar pneumonia, and in the other, broncho-pneumonia. These facts were important for the proper classification of the disease. In a case of poisoning, inquiry revealed that the taking of the poison had followed an attempted abortion. This additional information did not alter the assignment of the death to poisoning, but resulted in the abortion being assigned as the contributory cause. In connection with maternal mortality it has been the custom of the Bureau each year to make a special tabulation of the deaths which, while not assigned to puerperal causes, were nevertheless associated with a pregnancy or parturition. This tabulation is considered of great importance, and it is therefore essential that infor-

mation of this kind should be given on every death certificate to which it applies.

*Puerperal Deaths*

The subject of maternal mortality is one attracting widespread interest at the present time, and for this very reason it behooves a statistical office to exercise the greatest care with regard to the assignment of deaths to puerperal causes. While in a certain sense every death of a woman in pregnancy or childbirth is a maternal death, the term in its narrower sense is confined to those deaths which may be attributed directly to a cause arising out of the puerperal condition. It is not always easy, however, to determine whether responsibility for the death should be attributed to a puerperal cause or to some condition already existing before the pregnancy. Again, a pregnant woman may contract a disease such as a contagious or infectious disease entirely independent of her condition, and in these cases it is proper to assign the death to the contagious or infectious disease although her condition may have contributed to lowering her resistance. At the same time the puerperal condition would be taken in our office as a contributory cause in order to render it possible to obtain a total of deaths associated with the puerperal state, though not directly assigned to a puerperal cause.

But one of the greatest difficulties in dealing properly with this class of maternal deaths is a frequent total omission on the medical certificate of any reference to the fact that the woman was pregnant. It can be understood that in the case of an unmarried woman some delicacy attaches to the matter, and if the physician can honestly ascribe the death to some cause independent of the puerperal condition, his reluctance to mention that condition at all is natural. In some of these cases, however, the death could not be considered as due to anything but maternal causes and the completeness of statistics on this important subject is injuriously affected. What may appear somewhat strange is the fact that these omissions take place in the case of married as well as unmarried women.

So universal is this tendency to omit mention of the puerperal condition that the official publication of the commission which revised the International List contains the following instructions:—

> "Whenever a woman of child-bearing age is stated to have been the victim of a disease which might have been of puerperal origin, the certificate is to be returned to the physician in order that he may specify whether the disease was puerperal or not. This course is especially to be followed in regard to the following diseases:—abscess of the breast, albuminuria, eclampsia, embolism, haemorrhage, lymphangitis, metroperitonitis, sudden death, phlebitis, phlegmasia alba dolens, pelviperitonitis, peritonitis and septicaemia."

Following these instructions many certificates for deaths of women are returned by Provincial Offices or by the Dominion Bureau, particularly for such causes as peritonitis and septicaemia. In a number of cases the replies received from the physicians are to the effect that the disease causing death was puerperal in its origin.

Much trouble is occasioned by the too general use of the term "abortion" on medical certificates. In a number of cases we find this given as the cause of a woman's death, while a search of our files reveals a birth certificate for the child. There is, of course, here involved the question of definition. In our statistics we have been accustomed to take six months as the minimum period of gestation for either live or still-births when the period of gestation is stated. It may be argued that six and one-half months would be a better period.[2] This recommendation has been accepted by the Vital Statistics Section of this Association and is a matter which the Bureau feels must be taken up with the provinces in the near future. But at any rate, we do not feel that when a child has passed this period of six and one-half months the doctor should certify the mother's death as due to abortion. The practical importance of the matter for statistical purposes is that if we take the numbers of the new list, deaths due to abortion are classed to Nos. 140 and 141, according to the presence or absence of septic conditions. On the other hand, if the foetus has passed the stage where its expulsion may be termed an abortion, the death should be assigned to one of the other numbers in the puerperal class, according to the conditions mentioned on the certificate. It must be remembered that in practice it is not possible for a statistical office handling many thousands of death certificates every year to make searches through the files to see if the statement of abortion is corroborated by the absence of a birth certificate.

As an example of a case where it must be admitted that a conscientious physician appears to have stated every condition which appeared to have any bearing on the death, I may mention a death certificate received in 1930 for a married woman, 42 years of age. The cause of her death was dilatation of the heart, with chronic granular nephritis, exophthalmic goitre and anaemia as contributory. In addition the information was given that a Caesarean section was performed two days before her death. The period of gestation was eight months and she suffered from albuminuria and eclampsia. In this case, out of this *embarass de choix*, we assigned the death to the Caesarean section.

*External Causes*

Deaths from external causes are another class which afford considerable difficulty in their satisfactory classification, owing to the fre-

[2]*Since this paper was read, six and one-half months has been officially adopted in all provinces of Canada.*

quent insufficiency of the explanations made on the medical certificate. From the medical standpoint, of course, interest lies primarily in the nature of the injuries which bring about the death. From the statistical standpoint, these are of secondary importance. The death must first be classified as due to suicide, homicide or accident.

This information is sometimes missing and, incredible as it may seem, we have even had cases where the death has been certified to a condition brought on by an injury without any mention or hint of the accident in which the injury occurred. In the cases I have in mind, the fact of the accident was brought to our attention from some other source. Had it not been so, we should have had no opportunity of suspecting the fact. It can readily be understood that a doctor called in to treat a patient is more immediately concerned with that patient's condition than with the manner in which it was brought about. This no doubt accounts for the assignment of the death to this condition; nevertheless, it is self-evident that for any practical system of classification of causes of death, the nature of the violence which brought on the condition causing death is the really important thing.

The means by which the death was caused, or the injuries which resulted in death inflicted, next require to be known. For the satisfactory classification of accidents, many details are of importance. The circumstances of an accident determine its classification in many cases. Outstanding amongst all at the present day are vehicular accidents, and it is important to know what vehicles were involved and, particularly, whether an automobile or motorcycle figures in the accident. For example, when we receive a certificate stating that a person was killed at a railway crossing, it is important for us to know whether this person was on foot or in a vehicle, say an automobile. In the former case the accident is classed as a railway accident, in the latter case as an automobile accident, since a choice must be made between the two. The basis of our choice is the great public interest in the danger of automobile accidents and the general fact that trains are running on schedule on a fixed track, and therefore responsibility for the accident rests with the automobile or its driver. On the criterion of responsibility, of course, it might equally be claimed that an accident to a person on foot at a railway crossing is not a train accident but a pedestrian accident. It will be seen, however, that to make such a class of accidents for tabulation would destroy one of the primary purposes of classification as failing to show the source from which the danger for pedestrians comes. The whole subject of the treatment of accidents abounds with difficulties of this sort, which can be overcome only by cross-classification; but the point I wish to emphasize here is that it is essential to have on the certificate all important facts about the circumstances of the accident.

The following are examples of the necessity of additional information:—

(1) *Asphyxia by carbon monoxide gas* (probably accidental)—The answer to an inquiry was cryptic but expressive: "Automobile while engine running in garage."

(2) *Cerebral haemorrhage following a blow on the mouth*—Inquiry was made if the blow was received during a fight. The reply came back that the blow was administered by a certain person who was held criminally responsible.

(3) *Accidental death, killed by train*—Inquiry was made if automobile or other vehicle was involved and the nature of the injuries. Reply came back that the person suffered fracture of the skull and that the vehicle was a load of hay on railway tracks.

(4) *Asphyxia by drowning*—Without statement as to the circumstances. Inquiry showed that it was a boat accident.

(5) *Accidental crushing by car door*—Inquiry showed that this was a train accident.

(6) *Fracture of neck*—Cause not mentioned. Inquiry showed this was due to a railway accident.

(7) *Accidental flying plane*—This certificate did not state the cause of death, whether the plane landed in the water or on land or was burned. Inquiry showed that the cause of death was fracture of the skull due to a land accident.

In conclusion, may I say that the particular purpose of this paper has been to place before health officers, in a practical manner, the requirements demanded by the medical certificate for statistical purposes and the nature of some of the difficulties which are met with in the assignment to the proper group of the information entered on the certificate. The Bureau of Statistics appreciates greatly and desires to make acknowledgment of the pains which many physicians take to fill out the medical certificate. To those of us who are in daily contact with this matter, the improvement which has been made in this regard since the inception of the national system is very satisfactory. It is accepted as evidence that the medical profession in general is realizing the importance of mortality statistics as a record of the success of their efforts in the conquest of disease, and because of the realization of this fact they are always ready to furnish information in the detail required for statistical needs.

# Skin Sensitivity to the Elementary Bodies of Vaccinia

JAMES CRAIGIE, M.B., CH.B., PH.D., D.P.H. ST.AND., AND F. O. WISHART, B.A., M.D.

*Department of Epidemiology and Biometrics, School of Hygiene, University of Toronto*

IT is well known that the "early" or "immediate" reaction encountered in the revaccination of human subjects can be elicited with vaccine lymph which has been heated to kill the virus (1, 2, 3). This sensitivity reaction is specific to the virus (4), and its specificity is demonstrable by the failure of other constituents of vaccine virus suspensions to call forth the reaction. Recently it has been shown by Smith (5) that the reaction can be elicited by the intradermal inoculation of a heat-stable precipitating substance extracted from the vaccinia-infected testes of rabbits. This substance is probably essentially the same as the specifically precipitating substance which is found, free from virus, in Seitz filtrates of vaccine pulp obtained from the skin of rabbits (Craigie 6), and which gives a similar reaction in previously vaccinated individuals. The Seitz-filterable substance, although separable from the virus (elementary bodies), bears a close serological relationship to these bodies and appears to be a specific product of the virus (6). It is therefore not surprising that virus-free preparations of the specific precipitable substance of vaccinia should elicit the reaction, but since the specific precipitable substance evokes the sensitivity reaction the question arises as to whether vaccine virus, separated from this substance which accompanies it, can itself call forth the reaction. This question has been investigated and the effects of the inoculation of the washed, killed elementary bodies of vaccinia into the skin of unvaccinated and of immune human subjects and rabbits are reported in this communication.

*Preparation of Killed Elementary Body Suspensions.*

The elementary body suspensions were prepared from the skin of rabbits inoculated three days previously with a rabbit strain of vaccine virus. The technique of preparation has been described (6), and it is sufficient to state that the separated elementary bodies were subjected to repeated washing in an angle centrifuge. The suspensions thus obtained showed on microscopical examination a very high degree of purity and their densities were such that they showed a trace of opalescence and specific agglutination when diluted to 1 in 100. The suspensions, immediately after their preparation, had sufficient formalin added to them to give a concentration of 0.25 per cent of 40 per cent formaldehyde. After storage in the cold room for four weeks or longer, the suspensions were tested to ensure that no living virus persisted. The test consisted of injection of 1 cc. of the material into the testis of a normal rabbit, serial passage on the fourth day through the testes of two other rabbits and inoculation of the pulp of the third testis on the skin of a fourth rabbit.

Failure to recover the virus in this way was accepted as evidence that no living virus persisted in the suspension.

In the earlier tests on human subjects, dilutions of the suspensions of killed elementary bodies in saline or distilled water were employed, but in the more recent tests suspension which had been diluted with phenol glycerine and filled into capillary tubes has been used.

*The Sensitivity Reaction in Human Subjects.*

Suspensions of the elementary bodies of vaccinia (washed and killed), have been inoculated into the skin of over two hundred individuals. Intradermal injection of 1/20 to 1/50 cc. of suspension diluted 1 in 10 or more was employed at first, but the occurrence of a few severe reactions caused the abandonment of this method in favour of needle puncture through a drop of the suspension placed on the skin.

The reaction obtained in previously vaccinated individuals to intradermal injection of the killed elementary body suspensions is similar to that produced by the injection of the Seitz-filterable substance and to that obtained by Smith (5) with his preparations of precipitable substance. Around the site of inoculation the skin becomes red and elevated, and this zone of reaction is surrounded by a pink areola. The reaction reaches its maximum in 24 to 48 hours. Puncture inoculation calls forth a similar reaction on a smaller scale. A papule, distinctly red in colour, makes its appearance, and reaches a maximum usually in 24 to 48 hours. Frequently, but not invariably, the papule is surrounded by a pink areola, the margin of which is often indefinite. Regression of the lesion is variable, fading being more rapid in some individuals than in others.

The findings in all cases examined will not be presented in tabular form, since the technique of inoculation and dilution of inoculum has varied from group to group examined. With one exception, these groups have consisted almost entirely of individuals who had been previously vaccinated, and most had been re-vaccinated.

In most of these groups, control inoculations of puncture only, of rabbit skin extract and of calf skin extract were included, in addition to the inoculation of killed elementary bodies, heated calf virus and living calf virus. Reactions to the rabbit and calf protein controls were not obtained. Without exception, reactions to the killed, washed, elementary body suspensions and heated calf virus were obtained in the individuals previously vaccinated, while four unvaccinated individuals who gave a primary take with living virus did not react to either dead virus suspension.

One group differed from the others in that it comprised a large number of unvaccinated individuals, and will therefore be considered in detail. This group consisted of 130 girls of ages ranging from 10 to 16 years, the majority being over 13 years of age. The preparations used for the inoculation of the group were (1) vaccine virus of calf origin as issued for vaccination, and (2) a washed, killed, suspension of elementary bodies of rabbit origin (No. V10) in the same concentrations of phenol glycerine as (1). Access to the

group was limited and the short scratch method (1/16") was adopted for the inoculation of the living virus, while the puncture method was employed with the dead suspension. A control puncture was also made. (The scratch method is more certain in primary vaccination, while the puncture method produces the allergic reaction with more constancy (McKinnon & Defries 7). Inspection of the reactions was limited to the third and seventh days after inoculation.

The average transverse width of the reaction to the living virus and the diameter of the circular reaction to the killed elementary bodies were measured. The measurements recorded here refer only to the popular lesion, the variable areola being neglected.

TABLE I

SEVENTY-FIVE INDIVIDUALS WITH HISTORY OF VACCINATION* AND SHOWING ONE OR MORE SCARS

| Days after inoculation | Living calf virus | | | Killed (rabbit) elementary bodies | |
|---|---|---|---|---|---|
| | Number reacting | Mean of reaction | No reaction | Number reacting | Mean of reaction |
| 3rd | 75 | 2.86 | 0 | 75 | 2.83 |
| 7th | 12 (vaccinoid) | 5 mm | 63 (regression) | All showed definite regression of reaction | |

*One had smallpox.

The members of the group fall into three sub-groups. The first sub-group (table I) comprised 75 individuals who had a history of vaccination and showed one or more vaccination scars. All 75 showed, on the third day, a definite reaction to the killed, elementary bodies, and the mean of this reaction did not differ significantly from that of the reaction to living virus (2.83 mm. as opposed to 2.86 mm. for living virus). With both living and dead virus, 76 per cent of the reactions lay between 2.5 and 3.5 mm. None of the reactions were less than 1 mm. and only three were less than 1.5 mm. On the seventh day all reactions to the killed elementary bodies had definitely regressed, but in twelve cases the reaction to living virus had progressed to a vaccinoid reaction. The mean diameter of these vaccinoids on the seventh day was 5 mm. or only 0.27 mm. less than the mean of the primary takes (table II) on the same day. The mean diameter of the reaction of these twelve individuals on the third day to killed elementary bodies was 2.3 mm. or less than the mean for the whole sub-group, while the mean of their reaction to living virus on the same day (3.32) was greater than the mean for the whole sub-group.

It has been pointed out by McKinnon and Defries (7) that the "early" reaction is evidence only of previous vaccination and is not an index of immunity. The occurrence of these twelve vaccinoid reactions after a definite "early" reaction provides further evidence of the truth of this statement.

Table II deals with 52 members of the group who were stated not to have

been previously vaccinated. None showed vaccination scars on the arm. Neither on the third nor the seventh day did they show any reaction to the killed, elementary bodies. On the third day their mean reaction to living virus was less than that of the sub-group previously vaccinated (1.98 mm. as against 2.86 mm.). On the seventh day all reactions were proceeding to a primary take.

TABLE II

FIFTY-TWO INDIVIDUALS WITH NO HISTORY OF VACCINATION AND NO SCAR

| Days after inoculation | Living calf virus | | Killed (rabbit) elementary bodies |
|---|---|---|---|
| | Number reacting | Mean of reaction | Number reacting |
| 3rd | 52 | 1.98 mm | None |
| 7th | 52 | 5.27 mm | None |
| | Reaction proceeding to primary take | | |

TABLE III

THREE INDIVIDUALS WITH UNSATISFACTORY HISTORY

| Days after inoculation | Living calf virus | Killed (rabbit) elementary bodies |
|---|---|---|
| | Individual said to have been vaccinated and showing suggestive scar | |
| 3rd | 3.0 mm | 0 |
| 7th | 6.0 mm | 0 |
| | Two individuals with no scar or history of vaccination (One had been exposed to cow pox) | |
| 3rd | Mean 2.5 mm | Mean 2.5 mm |
| 7th | Regression | Regression |

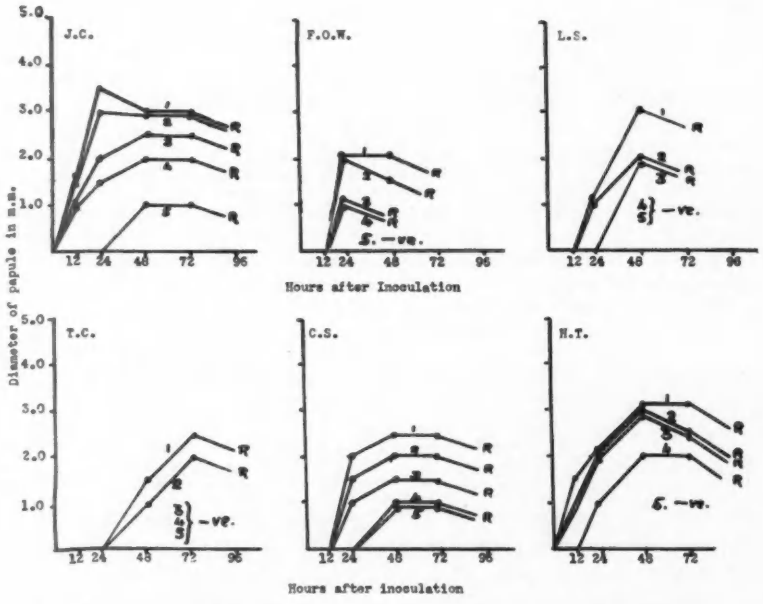
In table III the reactions obtained with the three remaining individuals are shown. They had an indefinite history, but their reactions to living virus permit of their classification. One, who was obviously not immune, did not react to killed virus, while the others who gave an "early" reaction to living virus reacted to the dead virus also.

The findings in this group confirm the observations made with the earlier groups. They show that killed, washed, elementary bodies of rabbit origin elicit an early reaction in previously vaccinated individuals, but produce no reaction in the absence of previous vaccination.

The elementary body suspensions employed in these tests were not excessively concentrated. On the basis of "potency" tests of fresh unformalized portions of the suspensions made by scarification of dilutions on the skin of rabbits, the killed suspensions probably did not contain more than five to ten times as much virus as a potent batch of glycerinated calf vaccine. In order to obtain some idea of the amount of dead virus necessary to evoke the sensitivity reaction, dilutions of killed, elementary body suspension V10 (tables

I, II and III) were punctured into the skin of six individuals who had been re-vaccinated several times. The reactions obtained are shown in figure 1. It will be noted that not only did the highest dilution to which each reacted vary, but that the time of maximum reaction also varied from 24 to 72 hours in the different individuals. Two individuals reacted to the 1 in 10,000 dilution of the suspension, and when the mode of inoculation (puncture of the skin with a needle through a drop of diluted suspension) is considered, it is obvious that sensitivity to excessively minute amounts of vaccine virus substance may occur, and that an extremely delicate test for this substance is available.

Reactions to Dilutions of Killed Elementary Body Suspension V10




1....Undiluted suspension of washed elementary bodies V10 in phenol glycerine.
2....Suspension diluted 1 in 10
3.... " " 1 in 100
4....Suspension diluted 1 in 1,000
5.... " " 1 in 10,000
6....Control puncture—negative in all sixe
R...Regression of papule.

As has been stated above, the Seitz-filterable precipitating substance of vaccinia will produce the allergic reaction, and the question arises as to whether the killed, elementary bodies themselves provoke the reaction or whether traces of the filterable substance present in the suspension, in amounts too minute for demonstration by the precipitin reaction, are responsible. That sufficient filterable substance to produce the reaction was not present in batch V10 of elementary body suspension is shown by the following experiment. A portion of killed, elementary body suspension V10 was passed through a Seitz filter

and tested on a sensitive individual (J.C., fig. 1) at the same time as dilutions of the elementary body suspension. The filtrate, even undiluted, caused no reaction. The reactions observed with this suspension are therefore referable to the elementary bodies and not to remaining traces of the specific filterable substance.

Two individuals have been examined after primary vaccination in order to determine how soon after vaccination sensitivity becomes manifest. Suspension V10, applied by puncture, was used. One individual showed no reaction to the material on the 10th, 12th, 14th and 15th days after vaccination, but a positive reaction was elicited to inoculation on the 17th day. The other, tested on the 19th day, showed a doubtful reaction, but reacted definitely to further inoculations.

*The Sensitivity Reaction in Rabbits.*

A number of authors have found the sensitivity reaction in vaccinia immune rabbits to be of very irregular occurrence (5, 8, 9, 10), although others (11, 12), appear to have observed it with greater frequency. In our own experience with the intradermal inoculation of Seitz filtrates from lapine pulp and with killed, elementary bodies, reactions have been extremely irregular.

In order to compare the sensitivity of rabbits with that of human subjects a representative group of twenty immune rabbits was inoculated by the puncture method with the same batches of living virus and washed, elementary bodies which were used in the inoculation of the group represented in tables I, II and III. The degree of immunization of the rabbits varied from that brought about by scarification with living virus to hyperimmunity conferred by repeated intravenous injections. The interval between vaccination and test varied from 5 months to 2 weeks. Only four rabbits showed any reaction to the killed elementary body suspension, and none of the reactions exceeded 2 mm. in diameter. None of the four reactors had received more than one previous inoculation of virus and in all inoculations had been made 3 to 6 weeks previously. The agglutinin titres of these four rabbits for elementary bodies lay between 1 in 40 and 1 in 80. Of the non-reactors, seven had been hyperimmunized and had agglutination titres of over 1 in 1,000, while the others had titres lower than 1 in 40. Calf virus, variola virus passaged through monkey to rabbit, and rabbit virus were employed in the primary vaccinations; two of the reactors were animals which had been vaccinated with calf virus and variola strain respectively, while the other two had been vaccinated with the rabbit strain. It is worthy of note that two other rabbits in the group which had been immunized with calf virus showed a sensitivity reaction to the calf virus but not to the killed, elementary bodies of rabbit origin.

## *Discussion*

The washed, killed, elementary body suspensions used to elicit the "early" reaction represent vaccine virus in a virtually pure state. Since they were of rabbit origin the possibility of sensitivity of the previously vaccinated individuals to calf protein need not be considered, while sensitivity to rabbit

protein was excluded in those groups in which unvaccinated individuals were few or absent. The failure of a Seitz filtrate of a washed, elementary body suspension to provoke the reaction indicates that the elementary bodies had been washed free from any "antigen" in solution, and that the reaction can be elicited by the particulate virus apart from any of its products. Thus the view that vaccine virus is responsible for the production of the sensitivity reaction encountered in re-vaccination is confirmed in a more direct way than is possible with suspensions of virus containing material of animal origin and soluble products of the virus.

It is of interest that the sensitivity reaction can be elicited with Seitz-filtrates of the precipitating substance of vaccinia as well as with the elementary bodies. This provides further evidence in favour of the view (6) that the filterable substance is a specific product of the virus.

Compared with human subjects, vaccinated rabbits show a comparatively low degree of sensitivity to vaccine virus. This difference becomes all the more striking when the high dilutions to which human subjects will react (figure 1) is borne in mind. It is to be concluded from the observations recorded here, and from those of others (5, 8, 9, 10), that in the immune rabbit sensitivity to vaccine virus is frequently poorly developed or absent, and, compared with that occurring in man, requires a comparatively large amount of "antigen" to elicit it. Regarding the influence of hyperimmunization or sensitivity in the rabbit, our own observations agree with those of Thompson (10), who found that hyperimmunization tended to decrease sensitivity.

## *Conclusions*

1. The elementary bodies of vaccinia, subjected to repeated washing and then killed, elicit an "early" reaction in previously vaccinated individuals when introduced into the skin. They cause no skin reaction in individuals who have not been previously vaccinated. The "early" reaction to vaccine virus is therefore a specific response to the virus in individuals sensitized by a previous inoculation with the virus.
2. Sensitivity and immunity to vaccine virus are not necessarily related, except in so far as they have a common origin in inoculation with vaccine virus.
3. Vaccinia-immune rabbits do not develop a degree of skin sensitivity to vaccine virus comparable to that observed in man, and frequently fail to develop any demonstrable sensitivity.

## REFERENCES

(1) Knoepfelmacher, W. (1907) Wien. med. Wachr., **57**, 1847.
(2) Pirquet, C. (1911) Z. ImmunForsch., Orig., **10**, 1.
(3) Force, J. N. (1927) U.S. Pub. Health Rep., **42**, 1031.
(4) Andervont, H. B., and Rosenau, M. J. (1930) J. Immunol., **18**, 51.
(5) Smith, W. (1932) Br. J. Exp. Path., **13**, 434.
(6) Craigie, J. (1932) Br. J. Exp. Path., **13**, 259.
(7) McKinnon, N. E., and Defries, R. D. (1931) Canad. Pub. Health J., **22**, 33.
(8) Dubrowinski and Rosenfeld, W. (1928) Cent. f. Bakt., Ref., **92**, 154.
(9) McKinnon, N. E., and Defries, R. D. (1928) Amer. J. Hyg., **8**, 93, 107.
(10) Thompson, R. (1930) J. Immunol., **19**, 63.
(11) Force, J. N., and Beckwith, H. L. (1915) J. Amer. Med. Assoc., **65**, 588.
(12) Hunt, L. W., and Falk, I. S. (1927), **14**, 347.

# Thomas Sydenham as Epidemiologist*

ASBURY SOMERVILLE, B.A., M.D., D.P.H., Toronto

SYDENHAM is known to the medical man mostly for the excellence of his description of a large number of diseases and his work as the "first great epidemiologist" is ordinarily forgotten. His fame is well earned and some of his descriptions have come down as classics but his contributions to preventive medicine are no less important, though less well remembered.

Sydenham was born in 1624 and was reared in Dorsetshire at the height of the Puritan uprising. His family provided much of the leadership which gave the Cromwellian Party such a hold on that part of the country. In time Thomas himself became involved in the battles and in due course received his reward from the hands of the party. Brought up in the austerity of a very Puritan home with a number of older brothers who were fighting the battles of right as they saw it, and under a mother whose character was such that she too soon became the mark for a Royalist weapon, it is no wonder that Thomas developed into a particularly upright man with a natural antipathy to tradition and prerogatives. As a young man he was sent to Oxford, but the course was soon broken up by the rebellion which left the University in Royalist hands, and Sydenham returned to Dorsetshire to fight for the rebels and, it is said, rose to the rank of Captain. Upon the success of the Cromwellian Party, Sydenham returned to Oxford, now operated by the Puritans, and within a year obtained a Fellowship that previously belonged to a Royalist, now expelled. In order to qualify for this position Sydenham received an M.B. "by creation," and probably also an M.A. in the same manner. One should remember that, although this seems an uncertain manner of granting degrees, apparently considerable care was exercised, as a year or so later the Royalist historian, Clarendon, admitted that the academic standing in Oxford was very high, in spite of the use of this method of paying political debts. His degrees were taken in 1648, and some time before 1661 he was in practice in London, though without license until 1663. The greater part of the intervening time was spent in Oxford, probably on medical or allied subjects, though the medical education as a university function was almost negligible. Before his licensure Sydenham went to southern France with a patient, and was apparently at Montpelier for about six months. Here again his Puritan training and his naturally iconoclastic attitude led him, not to the Medical School, but to the Protestant and irregular Barbeyrac, a man who left a profound mark on Sydenham's practice and life.

Upon his return to London Sydenham entered upon his real life work in the study of the epidemics of the city of London from 1661 to 1686

*Third in a series of historical articles prepared at the request of the Editorial Board.

and during this time published a number of books, none of which was very long. It would appear that these were all written in very plain English and were later translated into the customary ornate Latin of the time, though there is collateral evidence to prove that he had a very good reading knowledge of the language. We, therefore, in our English editions have the material at third hand and due allowance must be made for this. His writings give us a very good idea of the character of the man and a quotation seems in order. In the preface to the first edition of the "Medical Observations" we find the following:

"Whoever takes up medicine should seriously consider the following points: firstly that he must one day render to the Supreme Judge an account of the lives of those sick men who have been entrusted to his care. Secondly, that such skill and science as, by the blessing of Almighty God, he has attained, are to be specially directed towards the honour of his Maker and the welfare of his fellow-creatures: since it is a base thing for the great gifts of Heaven to become the servants of avarice or ambition. Thirdly, he must remember that it is no mean or ignoble animal that he deals with. . . .Lastly, he must remember that he himself hath no exemption from the common lot, but that he is bound by the same laws of mortality, and liable to the same ailments and afflictions with his fellows. For these and like reasons let him strive to render aid to the distressed with greater care, with the kindlier spirit and with the stronger fellow feeling."

In the same preface he goes on to add that the physician should not only do his best to cure the patient but that he should also do his best to give greater certainty to his art, so that the whole profession—and thus, ultimately, all mankind—may benefit.

Before leaving the character of Sydenham it might be well to refer to that apparent blot due to his retirement from London at the commencement of the Great Plague. Concerning this Sydenham himself merely states that he left the city, but gives no explanation and apparently does not seem to feel that any explanation is called for. It is rather difficult to label with cowardice a man who had fought bravely on the field of battle and above all when one sees the evidence of that higher form of bravery which fears neither the professional antagonism nor the ridicule which he saw that his writings would produce and which he bore to his dying day without question or rancour. One is therefore inclined to believe that there were some extenuating circumstances now unknown, or his numerous enemies would have made use of the material afforded.

A side light on the character of Sydenham is seen in his relation to his contemporaries. He had broken with tradition, recognizing only the works of Hippocrates, and had disregarded his professional associates. When one young physician applied for advice on medical reading material Sydenham told him to read Don Quixote. The two schools of medicine then in vogue, the anatomic, as exemplified by Harvey, and

the chemical, as exemplified in Mayow, were both ignored. Twenty years after the capillaries had actually been demonstrated, he even wrote his opinion that the connection between the veins and the arteries would never be seen.

His method of research is well described in that motto taken from Bacon, which Sydenham used on his *Schedula Monitoria:* "We have not to imagine or to think out, but to find out what Nature does or produces." Throughout his works one sees the evidence of careful observation, and the accuracy of his descriptions leaves little to be desired. Dr. Payne, who at the end of last century wrote the best life of Sydenham available, questioned the description of scarlet fever as being of a very mild disease, but he saw it at a time when the disease was very severe, while we of to-day recognize in the writings of Sydenham a very excellent description of this fever as we know it.

The following quotation from the preface to the third edition of *Medical Observations* shows his method well.

"In the first place it is necessary that all diseases be reduced to definite and certain *species*, and that, with the same care which we see exhibited by botanists in their phytologies; since it happens, at present, that many diseases, although included in the same genus, mentioned with a common nomenclature, and resembling one another in several symptoms, are notwithstanding, different in their natures, and require a different medical treatment.

"We all know that the term thistle is applied to a variety of plants; nevertheless it would be a careless botanist indeed, who contented himself with the general description of a thistle; who only exhibited the marks by which the class was identified; who neglected the proper and peculiar signs of the species and overlooked the characters by which they were distinguished from each other."

This idea of the specificity of each disease was later modified by Sydenham, as, much later, the botanists too modified their position, and he came out with the suggestion of a group of allied diseases grading gradually from one to the other. He also suggested the value of observing Nature's method of combating a disease for its worth in indicating methods of treatment and always drew a definite distinction between the destructive aspects of the disease and the reparative qualities of Nature; a distinction not previously well recognized. A third contribution to general medicine was his introduction of a new conservatism in prescribing, "for," he says, "it is sometimes as much the part of a skilful physician to do nothing as it is at others to apply the most energetic remedies."

Concerning his more direct contributions to preventive medicine, perhaps his idea of the "constitution" of epidemics has had the greatest influence, as it swayed the minds of men for about two centuries. His definition follows. "There are different constitutions in different years. They originate neither in their heat nor their cold, their wet nor the

drought; but they depend upon certain hidden and inexplicable changes within the bowels of the earth. By the effluvia from these the atmosphere becomes contaminate, and the bodies of men are predisposed and determined as the case may be, to this or that complaint. This continues during the influence of this or that constitution, which, after the cycle of a few years, gives ground, and makes way for another." This idea received a very severe blow on the advent of the germ theory of disease, but has recently been brought to the fore to explain the close relation noted between influenza, epidemic meningitis and epidemic encephalitis and perhaps also poliomyelitis (Hamer).

In the *Medical Observations* he also speaks of the seasonal incidence of various epidemic diseases and also of even such diseases as gout being more frequent at certain seasons of the year, and a very modern flavour might be read into the following, taken also from the *Medical Observations*, though it is probable that Sydenham would not recognize our interpretation. It does, however, show the idea of contagion both direct and indirect. "Over and above this constitution of the atmosphere and these general influences, there must be an additional determination in the form of a susception of the miasma; this means the admission of the morbid principle from some pestiferous body [he is speaking particularly of plague], either immediately and by close contact, or mediately from the transmission of fomes."

For gout and renal calculus he recommended "small beer which neither rises to the generosity of wine nor sinks to the debility of water" because water pure and uncooked is dangerous. It is difficult to make out whether he really recognized that the cooking of the water removed at least some of its potential dangers.

He also noted the existence of sporadic cases, the presence of unusual numbers of flies during epidemics of abdominal conditions, and that epidemics sometimes ended although there was still much epidemic food left in the district. Another innovation that he introduced was in the treatment of fevers and more particularly of the small pox which he treated by the "cooling method," as opposed to the system then in vogue of putting the patient to bed with the maximum of clothing and piling on more heat every time he moved or complained. Sydenham also required that the windows be kept open and no doubt the patients approved and did better under his regime, even if the neighbours did object to the open window.

As Dr. John Brown has said, in attempting to evaluate the work of Sydenham, "We must remember in the midst of what a mass of errors and prejudices, of theories actually mischievous, he was placed, at a time when the mania for hypothesis was at its height, when the practical part of the art was overrun and stultified by vile and silly nostrums."

# Sterilization of Eating Utensils

R. ST. J. MACDONALD, M.D., and GRACE M. FREEBORN, B.A.

*Department of Public Health and Preventive Medicine, McGill University, Montreal*

THE object of this study is to determine the efficiency of methods used for cleansing and sterilizing eating utensils in some food establishments in Montreal, to compare the results with those obtained by other workers, and to formulate bacteriological standards for scoring these places.

The need for proper care and treatment of such utensils scarcely requires proof. It has frequently been shown that presumably clean eating utensils in restaurants, hotels and institutions are infected with pathogenic bacteria. The organisms found are those associated with some of the sputum-borne and intestinal diseases, as influenza, common colds, tuberculosis, pneumonia, scarlet fever, diphtheria, whooping cough, Vincent's angina or trench mouth, typhoid, dysentery and diarrhoea. Therefore it is quite possible these diseases may be transmitted readily through the medium of improperly sterilized dishes.

The infective agents causing these diseases are transmitted by direct and indirect contact from an infected case or carrier among the patrons or personnel of the establishment. These organisms may be coughed or sneezed on dishes and eating utensils; they may be present in saliva left on dishes that have been handled or mouthed; they may reach the dishwater directly or indirectly from the washers or handlers or indirectly from dishes infected by the users.

If the rinse water is not of a temperature high enough to kill these disease-producing bacteria, the latter may infect other individuals who are served with these dishes shortly after they have been washed.

In this connection it is to be noted that utensils may have been properly cleansed and sterilized but subsequently become infected by handlers who are cases or carriers, or by dish towels; they may become unsafe if stored on an open shelf where they are exposed to the coughing or sneezing of infected employees or patrons; they may be occasionally infected by flies, insects or rats. It must be remembered that bacteria harmless to the carrier may on transference to another individual, and in a more favorable environment, become virulent and capable of producing disease.

It is certain that communicable disease carriers among food handlers are sometimes responsible for the spread of disease. Taking into consideration the number of carriers there are in any community, and the facility with which they spread infection, it is surprising to find how comparatively few cases of disease are traced definitely to food handlers.

Examinations made by Harris and Dublin (1) in 1917 of 1980 food handlers in New York City, revealed the following results:—

| | |
|---|---|
| Active cases of tuberculosis | 10 |
| Arrested or suspected cases | 15 |
| Active cases of syphilis | 19 |
| Suspected cases | 32 |
| Active cases of gonorrhoea | 6 |

Of the 51 cases of syphilis 30 were among the 695 waiters. This means one waiter out of every 23 was an active or suspected carrier of syphilis and one in every 36 had the disease in open, active form.

In a preliminary report (2) on the physical examination of food handlers in Pasadena, California, it is stated that 1041 were examined. The findings were:—

| | |
|---|---|
| Active cases of tuberculosis | 15 |
| Suspected cases | 10 |
| Positive blood test for syphilis | 62 |
| Typhoid history (not stated whether carrier) | 104 |

It is quite likely an examination of the patrons of restaurants would also show a considerable number suffering from communicable disease.

WASHING METHODS.

In some soda fountains, confectionery stores and ice-cream establishments, glasses and spoons are not washed at all. They are rinsed in luke warm water, drained, and used again, sometimes before they are dry. The tables or counter-tops are cleaned by passing a damp cloth or towel over the surface, an insanitary method that may transfer bacteria from one table to another.

*Dishwashing by Hand.*

In many hotels, restaurants, etc., dishes are placed in a large pan, washed by hand with hot water and soap or powder, then rinsed in a second pan containing water at a temperature usually below 48°C. They are then removed to a wooden drain-board and dried with towels or occasionally in the air. At a temperature of 48°C. there is no disinfecting action and in a short time both the dishwater and rinse water are teeming with bacteria.

*Mechanical Dishwashing.*

By this method the eating utensils are placed in large wooden trays or racks, which pass through the machines automatically. They are first washed by means of strong sprays of hot water, to which, usually, some preparation such as trisodium phosphate, or a similar product has been added. The racks move through the machine on a belt which travels at a set rate of speed. The utensils, having been washed in this manner, are rinsed by strong sprays of clear water, at or near the boiling point.

Usually the dishes are so hot on emerging from the machine that drying by hand is unnecessary. Some machines dry the utensils automatically by means of hot air blasts.

The success of this apparatus will depend upon the temperature of the water and the duration of the contact; when the temperature is too low the results obtained will be no better than those from the ordinary method of washing by hand. The most approved type of mechanical dishwashing machine is so designed as to admit of easy sterilization by boiling water or steam after the dishes have been cleansed.

PREVIOUS INVESTIGATIONS BY OTHERS.

At this point it is considered appropriate to indicate the results attained by several workers who, in recent years, have investigated the hygiene of eating utensils in public and private eating places.

Cumming (3) states that in an examination of 23 sets of tableware he recovered hemolytic streptococci in 91 per cent. Saelhof and Heinekamp (4) found the same organism, corresponding to the human type in 6.35 per cent of washed dishes and tableware in an examination of the eating utensils in nine restaurants in Chicago.

Cumming (3) recovered pneumococci from 17 per cent of nine sets of tableware, and Saelhof and Heinekamp (4) found them in 1.6 per cent of tableware in 63 examinations.

Cumming (3) isolated diphtheria bacilli from 2 per cent of 26 sets of tableware examined.

Saelhof and Heinekamp (4) recovered B. coli in 1.6 per cent of 68 examinations of tableware.

Cole (5) in discussing the prophylaxis of syphilis mentions several cases in which the infection was definitely transmitted through the use of the common drinking cup.

Taylor (6) showed that eating utensils used by "open" cases of tuberculosis carried virulent germs, and that they are potentially dangerous avenues of contagion. Cleaveland, Floyd and Frothingham (7) in a study of washed table utensils used by open cases of tuberculosis in 25 private homes, found that "wash water used to wash such utensils quite frequently contained virulent tubercle bacilli".

Cumming, Spruit and Reuter (8) found that of eating utensils used by cases of healthy carriers of the hemolytic streptococci, 87 per cent were still contaminated with this organism after they had been washed by hand. Also that 25 per cent of the animals inoculated with rinse-water specimens of hand-washed eating utensils used by open tuberculous patients, died from tuberculosis, and that eating utensil asepsis or pasteurization in the army, in public institutions, and among civilians gives a protection of 80 per cent against acute virus infection. During the great influenza epidemic of 1918-1919, Lynch and Cumming (9) showed in a survey of three different types of eating places that there were 85 per cent more cases among those who ate from hand-washed dishes which were not sterilized by boiling water.

Cumming (10) pointed out that the incidence of influenza-pneumonia in an industrial population of 252,186 was three times greater in those places where the dishes were hand-washed in lukewarm water than in those with mechanical dishwashing, and also showed that in an institutional population the influenza case rate was reduced by 66 per cent and the mortality rate by 55 per cent through the use of machine-washed dishes.

Lynch and Cumming (9) reported the average bacterial count in 54 specimens of dishwater from 10 different restaurants was 4,000,000 per cubic centimetre. They also found where the average temperature was 47°C. the bacterial count was 40,000 per cubic centimetre.

Dearstyne (11) found several thousand and in some cases several hundred thousand colonies on plate counts of hand-washed dishes.

Manheimer and Ybanez (12) reported that in an examination of six establishments in New York using mechanical dishwashing apparatus, the temperature of the dishwater in all cases but one (where it was under 70°C.) was at or slightly under 100°C. The bacterial counts on the water from the mechanical washer never exceeded 10 per cubic centimetre. The bacterial counts of dishwater from 16 establishments using the hand method ranged from 1,000 to 500,000 per cubic centimetre. The temperature of the water in this process never exceeded 45°C., a temperature which has practically no effect upon bacteria. The bacterial counts from artificially infected spoons and rims of cups in 28 places ranged from 100 to 50,000 per cubic centimetre. The bacterial counts from artificially infected spoons and rims of cups which had been mechanically washed and sterilized ranged below 50, and from the dishwasher were consistently below 10 colonies per cubic centimetre.

Lynch and Cumming (9) in an examination of mess kit wash-water found when the average temperature was 47°C. the bacterial count was about 47,000 per cubic centimetre; the count depending upon the temperature, the amount of water and the number of men using it.

TECHNIQUE EMPLOYED IN THIS STUDY.

Apparatus carried on inspection trip (for one restaurant):—10 sterile swabs; 10 tubes beef infusion broth; 5 lactose broth fermentation tubes; 1 Centigrade thermometer; 1 container of 10 cc. pipettes.

The procedure followed in taking swabs and in the examination of the restaurants is very similar to that of Behrend (13), who also recommended laboratory control of the hygiene and sanitation of eating places.

It is best to visit the restaurant when a meal is being served, so that the method of dishwashing may be observed, and utensils about to be used by patrons may be examined. The establishment itself is inspected first, and equipment, general appearance, etc., recorded on the chart. While dishwashing is in progress the temperature of the rinsewater is taken and all methods closely observed. When utensils are ready for use, one of each of the following is tested:—

(1) Spoon (bowl swabbed completely twice).
(2) Cup (inner and outer rim swabbed twice).
(3) Fork (prongs, upper side only, swabbed back and forth twice).
(4) Tumbler (swabbed on inside and outside rim twice).
(5) Knife (blade swabbed on both sides, without touching handle).
(6) Plate (top, around outer rim, swabbed twice).

Swabs are also taken of the following:—

(7) Rinse water.
(8) Tabletop.
(9) Drainboard (About three inches swabbed on surface of tabletop,
(10) Shelf. drainboard and shelf).

Tubes of broth are labelled with the numbers 1-10, corresponding to the above numbers. The swabs may be conveniently sterilized six to a test tube, and carried in these tubes. One swab is removed at a time, is moistened in the broth tube labelled No. 1, swabbed over the bowl of the spoon, then returned to broth tube No. 1, and so on. The swabs are left in the broth tubes and the latter are incubated for one hour at 37°C. on being returned to the laboratory. Swabs are removed from the tubes and sterilized. The broth is plated on agar, and the plates incubated 24 hours at 37°C. and counted.

The five lactose broth fermentation tubes are each inoculated with 10 cc. of rinsewater, while dishwashing is in progress. These tubes are incubated for 24 hours at 37°C., and the number of positive tubes reported on the chart. In those cases where eating utensils are not rinsed, tests are made on the dishwater.

LABORATORY FINDINGS.

From Table No. 1 it is evident that intestinal bacteria find their way on to utensils and into dishwater, as shown by the presence of members of the colon-aerogenes group in the rinsewater of nine restaurants out of sixteen examined. These results also show what would be expected, namely,

a marked reduction in the total count with water at higher temperatures. The higher the temperature of the rinsing water, the fewer the number of bacteria remaining.

TABLE I

BACTERIAL CONTAMINATION IN RELATION TO TEMPERATURE OF RINSEWATER

| Temperatures | B. coli (5 tube test) | Total count of swab from Rinsewater (plated) |
|---|---|---|
| 37 C. | All positive | Too numerous to count |
| 42 | " " | " " " " |
| 42 | " " | " " " " |
| 43 | " " | " " " " |
| 44 | 3 positive | " " " " |
| 45 | All positive | " " " " |
| 45 | " " | " " " " |
| 47 | 2 positive | " " " " |
| 47 | 1 positive | 520 colonies |
| 48 | All negative | Too numerous to count |
| 48 | " " | " " " " |
| 49 | " " | " " " " |
| 50 | " " | 570 colonies |
| 52 | " " | 188 colonies |
| 52 | " " | 300 colonies |
| 55 | " " | 4 colonies |

The following table shows that when eating utensils are properly cleansed and sterilized by boiling water, the total counts are very low, with an absence of members of the colon-aerogenes group.

TABLE II

STERILIZING EFFECT OF BOILING WATER

| | Bacterial Count of Hand-Washed Utensils | | | | | | |
|---|---|---|---|---|---|---|---|
| | Knife | Fork | Spoon | Cup | Plate | Tumbler | B. coli test |
| Private home..... | 0 | 0 | 0 | 8 | 7 | 11 | Negative |
| Private home..... | 0 | 0 | 0 | 5 | 13 | 3 | Negative |
| Large restaurant... | 0 | 0 | 0 | 5 | 0 | 2 | Negative |
| Large restaurant... | 1 | 0 | 5 | 20 | 0 | 14 | 1 positive |
| Hotel dining-room.. | 1 | 0 | 0 | 0 | 4 | 0 | Negative |
| Club dining-room... | 0 | 4 | 2 | 0 | 15 | 0 | Negative |

DRYING BY TOWELS OR AIR.

The following tables III and IV present the differences in bacterial counts of utensils, both machine and hand washed, when dried by towels or by air.

TABLE III

MACHINE WASHING WITH TOWELS OR AIR DRYING

| Machine washed | Knife | Fork | Spoon | Cup | Plate | Tumbler | Total |
|---|---|---|---|---|---|---|---|
| *Using towels* | | | | | | | |
| Average count of 3 restaurants..... | 30 | 78 | 72 | 88 | 43 | 16 | 327 |
| *Drying in air* | | | | | | | |
| Average count of 3 restaurants..... | 1 | 0 | 2 | 9 | 5 | 17 | 34 |

Of a total of 361 colonies from machine-washed utensils in 6 restaurants, 90 per cent of the colonies were from 3 restaurants where towels were used to dry the utensils instead of air drying.

TABLE IV

HAND WASHING WITH TOWELS OR AIR DRYING

| Hand washed | Knife | Fork | Spoon | Cup | Plate | Tumbler | Total |
|---|---|---|---|---|---|---|---|
| *Using towels* | | | | | | | |
| Average of 3 private homes and clubs.... | 23 | 3 | 8 | 12 | 9 | 6 | 61 |
| *Drying in air* | | | | | | | |
| Average of 3 private homes and clubs.... | 0 | 0 | 2 | 3 | 12 | 3 | 20 |

Of a total of 81 colonies from utensils in 6 private homes and clubs, 75 per cent were from establishments where towels were used to dry these utensils.

IMPORTANCE OF THE TEMPERATURE OF RINSE WATER.

In table V are presented the results of two large restaurants using rinse water at 80°C. and 50°C., respectively.

TABLE V

MACHINE WASHING WITH WATER OF TWO TEMPERATURES

| Type of Place | Knife | Fork | Spoon | Cup | Plate | Tumbler | Temp. | Dried |
|---|---|---|---|---|---|---|---|---|
| Large restaurant | 0 | 0 | 0 | 5 | 0 | 2 | 80 C. | In air |
| Large restaurant. | 137 | too num. | 68 | 1920 | too num. | too num. | 58 C. | With towels |

It is not sufficient (as shown in table V) to have mechanical dishwashing machines; they must be properly managed and operated. Both were well equipped large establishments, using similar types of dishwashing machines.

Poor results in one may be traced to the low temperature of water supplied to the machine, and to the fact that the towels used were not always freshly laundered ones.

IMPORTANCE OF SUPERVISION.

TABLE VI

HAND WASHING IN TWO RESTAURANTS

| Hand washed | Knife | Fork | Spoon | Cup | Plate | Tumbler | Temp. Dried |
|---|---|---|---|---|---|---|---|
| Small restaurant. | 0 | 4 | 2 | 0 | 15 | 0 | 50C. Towels |
| Small restaurant. | 11 | 137 | 143 | too num. | 21 | 108 | 45C. Towels |

The above results indicate that in the smaller restaurants hand-washed dishes are satisfactory if proper methods are followed. In the first case there were rigid rules of procedure to be followed by employees in the care of the eating utensils, towels, sinks, etc. In the second case there was little or no supervision, which resulted in the insanitary conditions shown by the high counts of the eating utensils.

DRAINBOARDS.

A study of drainboards using this laboratory method was made. In tests of 8 wooden drainboards, every test showed "colonies too numerous to count." In tests of 10 metal, metal-faced or porcelain tops, only 5 were similarly reported. From these results it is evident, from a sanitary viewpoint, that metal, metal-faced or porcelain drainboards are superior to wooden.

DISHWASHING IN PRIVATE HOMES.

The following results (table VII) show that the bacterial count of eating utensils in the home may be kept low by the use of proper methods.

TABLE VII

DISH WASHING IN THREE PRIVATE HOMES

| Temp. of dishwater | Temp. of rinsewater | Dried | Knife | Fork | Spoon | Cup | Plate | Tumbler |
|---|---|---|---|---|---|---|---|---|
| 55C. | Boiling | In air | 0 | 0 | 0 | 5 | 13 | 3 |
| 50C. | Boiling | In air | 0 | 0 | 3 | 0 | 11 | 12 |
| 48C. | Boiling | Towels | 0 | 0 | 7 | 6 | 4 | 10 |

BACTERIOLOGICAL STANDARD.

It should be stated that it is appreciated the finding of large numbers of bacteria on eating utensils and in the rinsewater does not of itself indicate the presence of pathogenic organisms. It is, however, proof of insanitary conditions. The finding of members of the coli-aerogenes group would be a danger signal. The bacteriological standard is perhaps the best single index of the sanitary condition of eating establishments, and it would therefore seem proper to score these places with respect to bacterial findings. A suggested standard for eating utensils as follows:

*Total Count*: Below 10—Excellent; Below 50—Good; Between 50-100—Poor; Over 100—Bad. Rinsewater should have a count of under 100 from the swab.

If the methods to be outlined are followed either in the public restaurants, etc., or the private homes, the bacteriological standard suggested above would seem to be a fair one—one that could be readily reached and maintained by the exercise of ordinary intelligence, cleanliness and care.

RESTAURANT INSPECTION.

In the carrying out of these suggestions in a practical way it is desirable that there be a preliminary inspection, in which all food establishments are scored and classified. The smaller eating establishments usually need the most attention.

These should be concentrated on and made to comply strictly with the regulations and standards, care being taken not to convey the impression that the proprietors are in any way being oppressed. When their ratings have been raised, and this can be accomplished through education, persuasion and compulsion, if necessary, then the inspection work can be conducted by a comparatively small number of inspectors possessing some knowledge of bacteriological technique. It would be quite feasible and practical to use the bacteriological score twice a year. In a city the size of Montreal this would require the services of six trained inspectors, who could readily score all restaurants, etc., twice a year. If it is considered worth while to inspect the food served in restaurants and hotels frequently, it is much more important to control the sanitation of the eating utensils in these places, as more diseases are transmitted by the latter than the former.

Dish cloths should not be used as they are just as insanitary as the common towel or drinking cup. Neither are drying cloths recommended; perhaps they might be tolerated in private homes when intelligently used for polishing dishes or silverware after they have been properly washed and sterilized. In this latter case clean fresh towels or cloths should be provided for each meal.

In our opinion, and for obvious reasons, it is not considered practical or advisable to recommend the use of chemical disinfectants in connection with the routine practise of dishwashing.

While it is appreciated that when the temperature of the rinsewater is 80°C. there is little danger of the survival of non-sporing pathogenic bacteria and while such a temperature can be easily and cheaply obtained by a "set" gas

heater, yet this method of sterilization frequently breaks down because of carelessness. Perhaps this is not a strong objection; nevertheless, it is considered more reasonable, satisfactory and practical, to ask that the rinsewater be kept at or near the boiling temperature. At the same time, the value of temperature taking is not under-estimated, and it should be done as a routine measure.

It was not our experience that the use of current steam or boiling water led either to the breaking or clouding of glassware previously washed in warm water, as is so frequently stated.

CONCLUSIONS.

From a review of the work of others and from our own somewhat limited investigations, it would appear that—

1. There is undoubted evidence of the transmission of some of the communicable diseases through the medium of improperly disinfected eating utensils in private homes and public eating places.

2. There is lack of appreciation on the part of the public of the possible danger of disease transmission through improperly sterilized eating utensils.

3. The sanitation of many restaurants, hotels, etc., is far below the accepted standard of cleanliness and safety.

4. It is not necessary to install costly equipment in the private home or public eating place in order to ensure safe dishwashing.

5. Mechanical dishwashing in the larger establishments offers a greater protection to health than washing by hand.

6. One of the best means of preventing many of the sputum-borne and intestinal infections both sporadically and epidemically is by means of proper sterilization of eating utensils.

## APPENDIX

# RESTAURANT INSPECTION

GENERAL RECOMMENDATIONS

1. Public health education with regard to the menace of insanitary eating establishments, the technique of washing, sterilization and storing of eating utensils, the desirability of using in restaurants and similar places sanitary drinking cups and straws. The staff should be instructed in personal cleanliness and in the mode of transmission of communicable diseases; also employees should be clean and tidy in their appearance, have clean clothes, hands, and nails. They should be told to handle dishes and utensils as little as possible and the advisability of not touching rims of cups and glasses, prongs of forks, and the bowls of spoons should be pointed out.

2. Pre-employment and periodic medical examination of employees.

3. Scoring and rating of eating places and requirement of bacteriological standards as well as sanitary standards.

*Large public eating places.*

Legislation should be passed compelling proprietors to install satisfactory mechanical cleansers, sterilizing and drying machines, and that the following procedure be followed—

1. The removal of all food by means of flexible rubber scrapers.

Proprietor _____ Trade Name _____

St. & No. _____ Permit No. _____ Date granted _____

Inspector _____ Ledger No. _____

| NOTICES No. | Served | DEPARTMENT OF PUBLIC HEALTH<br>Score Card<br>for Inspection of<br>RESTAURANTS, LUNCH ROOMS, HOTEL DINING-ROOMS,<br>Cafeterias, Soda Fountains, etc. | MED. CHIEF'S Male / Female<br>Reg'd.<br>Rec'd. |
|---|---|---|---|

| SANITATION | Date | | | | | | | REMARKS |
|---|---|---|---|---|---|---|---|---|
| | Perfect Score | Allowed | Allowed | Allowed | Allowed | Allowed | Allowed | |
| Floors | 2 | | | | | | | |
| Ceilings & Walls | 2 | | | | | | | |
| Lighting | 2 | | | | | | | |
| Ventilation & Hooded Stoves | 4 | | | | | | | |
| Garbage Disposal | 2 | | | | | | | |
| Screens | 2 | | | | | | | |
| Water Closets | 2 | | | | | | | |
| Water Basins | 2 | | | | | | | |
| EQUIPMENT & METHODS | | | | | | | | |
| 2 Deep Sinks | 6 | | | | | | | |
| Refrigeration | 6 | | | | | | | |
| Hot Water | 8 | | | | | | | |
| Dish Washing | 6 | | | | | | | |
| Sterilization | 12 | | | | | | | |
| Drying | 6 | | | | | | | |
| Storage | 6 | | | | | | | |
| Linen | 3 | | | | | | | |
| Table tops | 3 | | | | | | | |
| EMPLOYEES | | | | | | | | |
| Medical Supervision | 8 | | | | | | | |
| Neatness & Cleanliness | 5 | | | | | | | |
| Personal Habits | 8 | | | | | | | |
| Uniforms | 5 | | | | | | | |
| TOTAL SCORE | 100 | | | | | | | |

| BACTERIOLOGICAL SCORE | | | | | | | REMARKS |
|---|---|---|---|---|---|---|---|
| SWABS FROM | Plate count on agar at 37.5° C. incubated 24 hours<br>Dates on which tests performed | | | | | | |
| Spoon | | | | | | | |
| Cup | | | | | | | |
| Fork | | | | | | | |
| Tumbler | | | | | | | |
| Knife | | | | | | | |
| Plate | | | | | | | |
| Table Top | | | | | | | |
| Rinse Water | | | | | | | |
| Drainboard | | | | | | | |
| Shelf | | | | | | | |
| B. Coli Test | | | | | | | |

| | STANDARDS | SCORE |
|---|---|---|
| For counts of swabs of utensils | Excellent - below 10<br>Good - below 50<br>Poor - 50 - 100<br>Bad - above 100 | |
| For Rinse water | Good - under 100<br>Bad - over 100 | |
| For B. coli Test | Safe - 4 out of 5 tubes negative<br>Unsafe - More than 1 tube positive | |

BACTERIOLOGICAL SCORE
(Reverse Side of Card)

SCORE CARD FOR INSPECTION OF RESTAURANTS, LUNCH ROOMS, HOTEL DINING ROOMS, ETC.

2. Proper mechanical cleansing of utensils with hot soapy running water at a temperature at least 50 C. A suitable cleansing agent may be employed instead of soap.

3. Efficient sterilization by means of steam, or boiling water.

4. Satisfactory drying by means of machines or in the air.

5. Proper storage of equipment in insect and vermin proof metal cupbords.

*Smaller establishments.*

Speaking generally, it is most advisable to have mechanical apparatus for the washing and sterilization of dishes, and eating utensils, and where possible this method should be advised.

If, however, the expense of providing this equipment be considered too great, or if it constitute a hardship, it is recommended the procedure be as follows:—

1. Scraping of dishes to remove scraps of food.

2. Provision of two adjacent deep sinks made of porcelain, galvanized iron or wood with metal facing, and fitted with porcelain, metal or metal-faced drainboard. Running boiling water should be available.

3. The utensils should be hand-washed with a steel mop in warm, soapy water of a temperature of not less than 50 C.

4. The utensils should then be sterilized by being placed in a wire cage, which is raised and lowered several times in the second deep sink, containing clear running boiling water.

5. The utensils are finally allowed to remain in their wire baskets until dry.

6. They should be properly stored as recommended.

*For the home.*

If a water supply is laid on and proper sanitary conveniences installed the method described for small public establishments may be successfully employed. In rural districts the same method may be used, if two deep pans or pails are substituted for the sinks.

## REFERENCES


(1) Harris and Dublin. *Monograph Series No. 17*, Department of Health, City of New York, 1917.

(2) Hibben. *Monthly Bull.*, California State Board of Health, **16**: 93 (Dec.), 1920.

(3) Cumming, J. G. A Brief Review of Indirect Contact Transmission and a Preliminary Report of Corroborative Laboratory Research. *Am. J. Pub. Health*, **9**: 414 (June), 1919.

(4) Saelhof, C. C., and Heinekamp, W. J. R. Recovery of Streptococcus Hemolyticus from Restaurant Tableware, *Ibid.*, **10**: 704 (Sept.), 1920.

(5) Cole, H. N. Report of a Series of Sixty-One Extragenital Chancres. *J.A.M.A.*, **67**: 1805 (Dec.), 1916.

(6) Taylor, H. L. Are Eating Utensils Carriers of Tubercle Bacilli? *Am. Rev. Tuberc.*, **5**: 351 (June), 1921.

(7) Floyd, C., and Frothingham, L. Table Utensils as Sources of Tuberculous Infection. *Ibid.*, **6**: 51 (March 1), 1922.

(8) Cumming, Spruit and Reuter. *Mod. Med.*, **2**: 502 (July), 1920.

(9) Lynch C., and Cumming, J. G. The Distribution of Influenza by Direct Contact—Hands and Eating Utensils. *Am. J. Pub. Health*, **9**: 25 (Jan.), 1919.

(10) Cumming, J. G. Influenza-Pneumonia as Influenced by Dish-Washing in Three Hundred and Seventy Public Institutions. *Ibid.*, **9**: 849 (Nov.), 1919.

(11) Dearstyne, R. S. Comparison of the Bacterial Counts from Machine and Hand Washed Dishes and Their Significance. *Ibid.*, **10**: 871 (Nov.), 1920.

(12) Manheimer and Ybaney. *Am. J. Pub. Health*, **7**: 614, (July), 1917.

(13) Behrend. *Hygeia*, **7**: 985 (Oct.), 1929.

# EDITORIALS

EDITORIAL BOARD
R. D. Defries, M.D., D.P.H., *Chairman*
J. T. Phair, M.B., D.P.H., and N. E. McKinnon, M.B., *Associate Chairmen*
R. L. Randall, *Editorial Assistant*

G. D. Porter, M.B., *Public Health Administration.*
A. L. McKay, B.A., M.B., D.P.H., *Epidemiology and Vital Statistics.*
A. L. McNabb, D.V.Sc., *Laboratory.*
Gordon Bates, M.B., *Social Hygiene.*
E. W. McHenry, M.A., Ph.D., *Food, Drugs and Nutrition.*
Mary Power, B.A., *Public Health Education.*
R. R. McClenahan, B.A., M.B., D.P.H., *Books and Reports.*
D. T. Fraser, B.A., M.B., D.P.H., *Mental Hygiene.*
A. E. Berry, M.A.Sc., C.E., Ph.D., *Public Health Engineering.*
Barbara Ross Hanna, Reg.N., *Public Health Nursing.*
J. G. Cunningham, B.A., M.B., D.P.H., *Industrial Hygiene.*
James Craigie, M.B., Ch.B., Ph.D., D.P.H. St. And., *Current Health Literature.*

## DIARRHOEA AND ENTERITIS IN INFANCY

THE infant mortality rate has been said to be the best index of the intellectual progress of any state or community. This presumably implies that the knowledge of the individual members of such community, in terms of accepted measures for the prevention of such diseases as are prone to affect this age group, is greater than average, and that this knowledge is reflected in the permanent adoption of official measures aimed at assisting in the control of the contributing factors.

What percentage of the deaths occurring in the first year of life is controllable is an open question. Consideration of the cause shows that, during the last two years in Ontario, 17 per cent of the deaths in the first year are due to diseases of the digestive tract. When the child health movement was first initiated in a large way, it was felt that, in view of the controllability of deaths from this cause, emphasis should be placed on this aspect of the problem. Efforts were made to impress all the people with the fact that the cause of this disease was the introduction into the alimentary canal of certain harmful organisms, largely through the use of contaminated food or water. Municipalities were urged to protect their residents by ensuring a safe water and milk supply, and those coming in contact with children were impressed with the extraneous character of the causative agent. This campaign has supposedly been carried on in every well organized urban community in Canada, not as dramatically perhaps, as at the time of its inception, some fifteen years ago, but still it has had a well defined place in the health programme. And what have we accomplished according to the statistical data available? Again, confining our observations to the province of Ontario, we find that, while in 1916, 15.5 per cent of the total infant deaths were said to be due to diseases of the digestive tract, in 1930 the percentage had reached 18.9, with marked fluctuations in between these dates. The curve is an interesting one, showing a sharp drop in 1917, with a gradual rise to 1921, than a distinct downward trend for some years, with a sustained rise during the last four years. The conclusions are evident: namely, that there

are still too many infants and young children, through individual ignorance or municipal carelessness, exposed to the infecting organisms. The implications are not so obvious; do we, however, as workers in this field, need a redirection as well as a redoubling of our efforts?

*J. T. Phair*

## MORTALITY STATISTICS

THE value of our death statistics depends on their portraying accurately the related facts, particularly the medical findings. Mr. E. S. Macphail, in his excellent communication in this issue, stresses the need for a better understanding of the terms "cause of death" and "contributory cause." There is undoubtedly confusion in the minds of the profession concerning the use of the terms. By "cause of death" is meant the disease present at the time of death, which initiated the train of events leading thereto, and not a mere secondary, contributory, or immediate cause or terminal condition. Contributory causes are of two distinct kinds,—those causally related, such as complications and terminal conditions, and those independent of the disease which may have contributed to the fatal outcome. From the causes enumerated by the physician a choice must be made to permit of classification, for only one title can be recorded for each death. Rules have been formulated, therefore, for the guidance of those responsible for the final classification. To give uniformity in procedure, these rules provide that certain causes be given precedence over other causes, even though the latter be named as the primary cause by the physician. Diabetes, for instance, takes precedence over the majority of other stated causes, with the result that a larger number of deaths are recorded as diabetes than were certified by physicians as the cause of death. As the rules for classification are subject to change in conformity with changes in diagnosis, etc., it is imperative that in the study of mortality statistics of any disease over a period of years due attention be paid to the rules of classification applying during that time.

To make available the valuable data concerning the contributory cause, the Dominion Bureau published in 1929, in a special report, the returns for Canada for the year 1926. This volume enables one to make a study of the deaths from any disease in relationship to other diseases or conditions which may have been certified as either contributory of primary by the physician. In the preface, the Bureau states that "it is hoped that this publication may be made at least once in every five years." It is to be sincerely hoped that the next volume will be proceeded with, and published next year.

Our mortality statistics yield us information of true value in proportion to our accuracy in certification, recording, and care with which the tabulated data are interpreted. The information presented in Mr. Macphail's paper should be made available to every physician.

*R. D. Defries*

# PUBLIC HEALTH ENGINEERING

## *The Oligodynamic Action of Silver in the Treatment of Water*

J. GIBBARD

*Laboratory of Hygiene, Department of Pensions and National Health, Ottawa*

IT has been well-known for many years that metallic silver possesses a marked inhibitory effect upon bacteria. Naegeli (1893) was the first to describe this action and called it "oligodynamic." Recently a process of treating water, which depends upon this "oligodynamic" action of silver has been patented in America and abroad. The claims made for this process are so striking that it was considered advisable to conduct an invesigation into the basic principles and to review the whole field without any thought of commercial prejudice.

During the past fifteen months considerable experimental data have been obtained which are here presented in abstract form. Experiments were conducted by exposing B. coli to silvered porcelain rings under a variety of conditions. The silver was deposited on the porcelain rings by a usual chemical reduction method. A great many experiments were also conducted with a commercial sterilizing device utilizing this principle. The results may be summarized as follows:—

1. Neither the colour, odour nor taste of water is affected by several hours' exposure to silvered porcelain.
2. Under favorable conditions water containing several million B. coli per cc. may be "apparently" sterilized after two hours' exposure to silvered porcelain rings, while under unfavorable conditions twenty-four hours may be required.
3. Thus far it has not been possible to show that the effect of silver on B. coli is bacteriostatic, although results indicate that further study is necessary to determine this point.
4. The temperature at which contaminated water is exposed to the action of silvered porcelain rings, markedly affects the rate of action on B. coli; low temperature 8-10° C. as compared with 22-25°C. may decrease the rate of action from two hours to seven hours.
5. The presence of added organic matter also reduces the rate of action. A considerable decrease in the rate of action was noted when cultures in broth instead of from agar were used in the preparation of the suspensions of B. coli.
6. Silvered porcelain rings gradually lose their activity after continued use, even with distilled water suspension of B. coli, but may be completely rejuvenated by treating with dilute HCl.

7. It was found that silvered rings were not as active in the light as in the dark. The difference was not great, but it was definite. It is evident that there is some photo effect that needs further study.
8. There is a very definite time of exposure factor necessary to obtain any satisfactory results, even under the most favorable conditions, such as distilled water suspension of approximately 1,000,000 B. coli per cc. from an agar slant. At least one to one and a half hours' exposure was found necessary when using newly silvered rings.
9. Water which has been exposed to silvered porcelain rings may "sterilize" other contaminated water added to it.
10. It has been found that the concentration of silver increases with the increase in the time of exposure. After one hour's exposure there was found to be 0.03 ppm. of metallic silver; after two hours', 0.07 ppm.; after three hours', 0.15 ppm.; and after four hours', 0.5 ppm. of metallic silver. Determinations were made by the use of the spectroscope, since it was found that chemical methods were not delicate enough.

It may be concluded, as a result of these laboratory studies, that although the application of the oligodynamic action of metallic silver to the treatment of water has some points of considerable interest, it cannot at the present time be recommended for practical use. Temperature, organic and inorganic constituents inhibit the "oligodynamic" action of silver towards B. coli to a degree which renders the results doubtful.

Furthermore, the definite, rather prolonged time factor which markedly increases under unfavorable conditions, necessitates constant and careful bacteriological control. The lack of a simple, delicate test for silver, similar to that for chlorine, would require water to be stored until a bacteriological analysis could be completed.

The details of the experimental data will be published at a later date.

# *News of Engineering Interest*

## CALGARY INVESTIGATION

There has been held in the city of Calgary in recent months an investigation concerning the construction of the Glenmore Dam and water treatment works recently completed for that city. This enquiry was held before the Honorable Mr. Justice Ewing of the Supreme Court of Alberta, and was directed towards the following:

First, as to whether any official or officer in connection with the work had been guilty of misconduct. Second, as to whether the expenditures in connection with the project were justified and whether any person was deserving of censure. After a lengthy hearing, Mr. Justice Ewing brought in a report in which he clearly stated that no censure could be placed upon anyone, and that there was nothing whatever to indicate any misconduct upon the part of anyone connected with the project. His report lauds the undertaking and in summarizing he states that in all the evidence bearing on the construction of the entire system he is unable to find any single act which was not done in good faith, or which

was not done in the exercise of what was at the time a sound judgment.

The report is interesting in that it is a clear indication of the lack of wisdom shown by those responsible for forcing the enquiry. The investigation was apparently caused by some uninformed persons and in order to clear all officials and those who had anything to do with the work the enquiry was felt desirable.

### NEW CROSS-CONNECTION BY-LAW FOR MONTREAL

Recently a new by-law has been put into force in the city of Montreal which deals with the cross-connection of municipal water mains and those used in factories for fire or industrial purposes. It is pointed out that it has been the practice in the past to draw water from the St. Lawrence River, the Lachine Canal and from other sources for use in the industrial plants. This practice will now be prohibited under this by-law unless a permit has previously been obtained from the executive committee of the city. The permit will be granted only after a favorable report from the health officials and from the Public Works Department.

As in other cross-connection regulations, it is now prohibited to make any connection between the municipal mains and those used for industrial or fire purposes. The Health Department is given authority to permit the use of elevated tanks or underground tanks open to atmospheric pressure as long as the water from the city mains is taken at a point above the highest water level. In the case of existing arrangements temporary cross-connections may be continued if made through all bronze, rubber seated, double check valves, and bearing the approval of the Health Department.

Provision is also made in the by-law to require the painting of the piping systems distinctive colors. Green is to be used for the municipal mains and red for the others. Fountains, sinks, wash basins, etc., are to be connected only to the municipal water works or to a source satisfactory to the Department of Health.

This by-law should serve a very useful purpose in preventing contamination of the domestic water supply. It is similar to by-laws which have been passed in other centres and its necessity is well recognized.

### NEW WATER TREATMENT PLANT AT HUNTSVILLE

The new water filtration plant recently completed at Huntsville was officially opened on December 28th. This is a gravity mechanical filtration plant with a capacity of 600,000 Imperial gallons every 24 hours. It takes water from the bay. It is highly colored but very soft. The new plant effectively removes the color and gives a very attractive water. The citizens of Huntsville are fortunate in having a water supply which contains so little hardness.

In order to secure best results in the filtration, it is necessary to use soda ash along with the alum, and also to correct the acidity after filtration with soda ash. This plant is interesting in that it is of a very modern type in spite of the small capacity provided.

# PUBLIC HEALTH NURSING

## *The Relation of Industrial Nursing to Public Health Nursing*

HAZEL A. LATIMER, REG.N.

*Industrial Nurse, The E. B. Eddy Company Limited, Hull, Quebec*

INDUSTRIAL nursing is an integral part of public health nursing and is not something apart or complete in itself. The basic objective of all public health nursing is the adaptation of the individual to a suitable environment that makes health possible. The environment may be the school, the home or the plant, and each offers situations which must be adjusted before there is complete co-ordination of all things necessary for the promotion of health and happiness. If industrial nursing shares this basic objective with other activities in the health field, it becomes evident that the service is not that of one unit alone, but a part of a great machine designed to produce the most satisfactory adjustment of the individual to his environment. Therefore, the industrial nurse must be in gear with this machinery for human adjustment, and has a real contribution to make to this process both in and out of the plant, if she is to perform her part in proper correlation with all other agencies.

In addition to being a graduate registered nurse, she should have training in the principles and practices of public health nursing. With some executive ability, courtesy, tact, good judgment and a sympathetic understanding, she will be fairly well equipped to meet and solve the problems that come to her day after day in the industrial nursing field. As the work of the public health nurse is largely that of teaching, she must be capable of imparting that knowledge effectively.

Speaking from my short experience in industry, I feel that my long experience as a Victorian Order nurse has enabled me to visualize the home conditions of the employees and an endeavour is made to impart the knowledge of health so that it may be easily assimilated by each individual.

Is the nurse just graduating from a hospital fully equipped with sufficient knowledge of people and their home environment to enter industry? Emphatically, I would say "No." She must have public health training, and experience.

The corporation that wants vital work done by the industrial nurse must know the essentials which it ought to demand in the way of qualifications, for without certain essentials the work will fail.

*Organization.*

The industrial nurse organizing her own department when there has been no medical service, has no easy road to travel. She gets her training in the hard school of experience, and to handle such a situation she must have public health training. The duties of

an industrial nurse will depend largely upon the particular need of the industry by which she is employed, and also upon the particular kind of medical service which has been visioned by her employer. He too probably needs some education along the lines of industrial health. Many employers have only the thought of caring for injuries and giving such first aid as is covered by the legal aspect of the case.

*First aid.*

The industrial nurse usually has an entrance to industry through the first aid department, but her value is shown by applying her services to every phase of public health work.

In many plants systems of first aid are well developed. The fact that the industry is large does not necessarily imply that its medical and safety organizations are better than those of a smaller plant. In a great number of the large industries, the medical organization is both elaborate and extensive and employs a staff of physicians and several nurses. Other companies employ a part time physician and one or more nurses, according to the size of the plant, and there are still others where one nurse is employed and a panel of doctors is maintained for the employee to choose from when the injury is serious enough to require medical attention. The latter is the type used in our plant and is the type which places greater responsibility upon the nurse.

In the plant a well equipped hospital unit has been installed, consisting of office, first aid and rest rooms. The floors have been covered with battleship linoleum and the first aid room is equipped with sterilizers, two sinks, and a cabinet for instrument and medical supplies. The rest room is equipped with a hospital bed, bedside table, etc.

A card index of all accidents is kept, a card being maintained for each employee reporting to the first aid room. On this is entered the nature of the accident and the treatment.

All employees are requested to report to the First Aid Department for treatment regardless of how minor their injuries may be. The injured employee is given first aid treatment, advice in safety, and is assured that it is just as important for him to come for treatment as it is for his less fortunate fellow worker who suffers a major injury. He is reminded that his neglect of reporting a minor injury may cause the development of a severe infection which would probably mean loss of life or loss of time and money to himself and to the company. As teaching is one of the media through which the industrial nurse makes her contributions to the health programme, she is able to interpret the laws of prevention, as well as the application of nursing skill during time of illness.

First aid cabinets are maintained in various departments of the plant to give temporary relief in the absence of the nurse during the day, and also for the employees on the night shifts. These cabinets are in charge of qualified first aid men who make a written report of all injuries cared for by them. The cabinets are inspected and the supplies renewed periodically. Throughout the plant and in the locker rooms for men and women, special notice boards have been installed, on which safety first literature is posted. This is changed frequently.

A meeting of the safety and welfare committee is held monthly, at which the company nurse is invited to be present, for the discussion of

any problems that may have arisen dealing with health hazards and safety and accident prevention.

The importance of the safety and welfare department has come more and more to lie not so much in the handling of accident cases after they have occurred, as in the prevention of industrial accidents, and the activities of safety associations and industrial departments have been along the line of education of employees to guard against the danger of accidents.

*Sanitary inspection.*

During sanitary inspections special attention is given to the condition of employees in an attempt to discover incipient illness. The inspection of lunch rooms, rest and toilet rooms, offers excellent opportunities to develop practical health education. This is ideal preventive medicine.

*Medical examination.*

To ensure physical fitness, all employees are given a thorough medical examination before being hired. Record of this examination is maintained on a card index system. The result of the physical examination used as a basis for the placing of employees contributes to the reduction of accidents, which means lower manufacturing costs. The building up of physical fitness means the building up of a highly efficient organization, resulting in better service.

*Home visiting.*

Home nursing is not included in our activities. The only home or hospital calls made are to employees injured at the plant or when a foreman requests that a sick absentee be visited. By visiting in the home the nurse more readily gains the confidence of her fellow workers and learns their personal background and history. Industrial efficiency depends so closely on a healthy, happy home life that when home visiting is done and the right contact established with the employee, a splendid opportunity is provided for education of the family in the habits of health.

*Value to the Community.*

The importance of the industrial nurse as a factor in the community will depend first on herself and second on the initiative allowed by her employers. The nurse should make it one of her duties to discover all the resources of the community that may aid her in her work. Whether working solely in the plant or in the homes as well, the nurse will have frequent need of information from some of these sources. She can do valuable work in promoting pleasant industrial relationships, in reducing time lost through accident and illness, in minimizing the results of accidents by first aid and follow-up care, in shortening illness by co-operation with employers and outside agencies, and so making possible healthy, thrifty home life and increasing the efficiency of the work. As a public health worker she brings to industry a knowledge of community resources that enables her to adapt the industrial health programme most effectively to the larger programme in the community.

The evolution of the nurse from her lowly position of drudgery to the highly specialized worker of the present day has carried in its wake greater responsibilities and greater obligations. She has become a recognized part of the public health programme and in this work holds an unique place between patient and doctor, employee and employer and the community as a whole.

# NEWS NOTES

## Federal Grants, 1933

THE following grants appear in the estimates of the federal government and were recently tabled in the House: Canadian Council on Child and Family Welfare, $9,000; Canadian Tuberculosis Association, $22,500; Canadian National Committee for Mental Hygiene, $9,000; Canadian Branch of the St. John Ambulance Association, $4,500; Canadian National Institute for the Blind, $18,000; Victorian Order of Nurses, $9,000; Canadian Red Cross Society, $9,000; and the Montreal Association for the Blind, $4,500.

## The Mental Hygiene of Unemployment

THE National Committee for Mental Hygiene have prepared a sixty-four page booklet entitled "Morale: The Mental Hygiene of Unemployment," by Dr. George K. Pratt and presenting in a sympathetic, instructive and practical manner, in language as free as possible from technical terms, such psychological aspects of the problem of unemployment as how people react to deprivation and frustration; what is meant by *emotional* as against *economic* insecurity, etc. Single copies are priced at twenty-five cents and may be obtained from the offices of the Committee, 450 Seventh Avenue, New York.

## British Columbia

THE Vancouver city council has recently, in co-operation with the Vancouver General Hospital board and the Vancouver Rotary Club, placed all tuberculosis activities under the city health department.

The Tuberculosis Building (formerly ward O of the Hospital), and the Infectious Diseases Hospital, are under the control of the medical health officer as the active treatment centre. The Rotary clinic has been transferred to up-to-date quarters in the centre. Separate annexes for different types of the disease have been opened; two downtown clinics, one for Japanese and one for Chinese, are held weekly and semi-weekly, respectively; and the staff of visiting nurses has been enlarged. The following tuberculosis specialists have been appointed to the health department staff: Dr. W. H. Hatfield, Dr. P. W. Barker, Dr. Wm. Morris, and Dr. C. A. Ryan.

---

Dr. J. G. McCammon has returned to Burnaby after completing his post-graduate studies in public health at the School of Hygiene, University of Toronto.

## Alberta

FOLLOWING the completion of their post-graduate studies in public health at the School of Hygiene, University of Toronto, Dr. G. M. Little and Dr. W. G. Saunders have returned to resume their duties as medical officers of health in charge of the Red Deer and Okotoks-High River Districts, respectively.

## Saskatchewan

THE Saskatchewan Department of Public Health has been giving a series of weekly broadcasts over radio station CHWC, Regina. Short talks of from five to nine minutes are presented by members of the staff, while the remainder of the fifteen-minute period is occupied with musical numbers. Mr. Fred Hill is in charge of the programmes.

---

Miss Kathleen Rowlay, Reg.N., formerly a member of the Saskatchewan public health nursing staff in the rural health district at Gravelbourg, is attending McGill University, having been awarded the fellowship for post-graduate study offered annually by the Registered Nurses' Association of Saskatchewan.

### Ontario

ON Friday, February 3rd, the new surgical wing of the Toronto Hospital for Consumptives at Weston was formally opened by His Excellency Lord Bessborough, Governor-General of Canada. The first sanatorium in Canada was opened in 1896; the Toronto Hospital at Weston, overlooking the Humber River, was opened in 1904. In 1913 provision was made for the care of consumptive children by the erection of the Queen Mary Hospital on the same property. The building now opened is for the surgical treatment of the disease and completes the provision for adequate treatment. By this addition of this hundred-bed structure, the hospital can care for 570 patients.

### Quebec

"THE END OF THE ROAD," with its supplementary features dealing with the anatomy and physiology of reproduction, social hygiene for women and medical examination before marriage, has been shown recently in the province of Quebec by the Canadian Social Hygiene Council. It is reported that approximately 70,000 people saw the picture in a period of three weeks in Montreal and Quebec City. The sale of the Council's literature, printed in French and English, was very heavy. An interesting feature was the issuance of a pamphlet endorsing the picture and the campaign against venereal diseases by the Medical-Chirurgical Society and La Societé Médical of Montreal.

### New Brunswick

PROFESSOR ROY FRASER, of Mount Allison University, Halifax, has been elected a Fellow of the Royal Microscopic Society of England in recognition of his research studies in bacteriology, particularly those in infectious jaundice.

---

REPORTED CASES OF CERTAIN COMMUNICABLE DISEASES IN CANADA*

TOTAL FOR THE WEEKS† ENDING JANUARY 7, 14, 21 AND 28, 1933

| Diseases | P.E.I. | Nova Scotia | New Brunswick | Quebec | Ontario | Manitoba | Saskatchewan | Alberta | British Columbia |
|---|---|---|---|---|---|---|---|---|---|
| Diphtheria | — | 6 | 21 | 121 | 80 | 23 | 9 | 4 | 3 |
| Scarlet Fever | 1 | 32 | 34 | 287 | 345 | 60 | 45 | 13 | 40 |
| Measles | — | 67 | 47 | 230 | 1947 | 16 | 5 | 29 | 104 |
| Whooping Cough | ‡ | ‡ | ‡ | ‡ | ‡ | ‡ | ‡ | ‡ | ‡ |
| German Measles | ‡ | ‡ | ‡ | ‡ | ‡ | ‡ | ‡ | ‡ | ‡ |
| Mumps | — | 4 | — | — | 764 | 67 | 4 | 1 | 57 |
| Smallpox | — | — | — | — | 4 | — | 10 | — | — |
| Cerebrospinal Meningitis | — | 2 | 1 | 2 | 9 | 1 | — | 1 | 1 |
| Anterior Poliomyelitis | — | — | — | 10 | 7 | — | — | — | — |
| Typhoid Fever | — | — | 7 | 39 | 26 | 11 | 1 | 3 | 4 |
| Trachoma | — | — | — | — | — | — | — | — | 9 |

*Reported by Provincial Health Departments to the Department of Pensions and National Health.

†In Nova Scotia the week ends Wednesday; in Manitoba, on Friday; in all the other provinces, on Saturday.

‡Not reportable.

# CURRENT HEALTH LITERATURE

*These brief abstracts are intended to direct attention to some articles in various journals which have been published during the preceding month. The Secretary of the Editorial Board is pleased to mail any of the journals referred to so that the abstracted article may be read in its entirety. No charge is made for this service. Prompt return (after three days) is requested in order that the journals may be available to other readers.*

---

### Immunotransfusion in Scarlet Fever

Scarlet fever is, at the present time, a comparatively mild disease with a low case fatality rate. Any further decrease in this rate would seemingly be best accomplished by centering attention on cases critically ill, and with this in view the method of immunotransfusion has been developed. Persons convalescent from scarlet fever (15th day to four months) have been used as donors, whole unaltered blood being transferred directly from vein to vein. The author finds that immunotransfusion is superior to other methods in the treatment of acute septic scarlet fever, but in malignant toxic scarlet fever the results are less favorable than with scarlet fever streptococcus antitoxin.

Stephenson, Ruth, *J.A.M.A., 100*: 100 (Jan. 14), 1933.

### Epidemic Serous Meningitis

Two cases, in close sequence, which presented acute signs of meningitis, unassociated with other disease and proceeding to complete recovery, are described. Apart from an increase in pressure, the cerebrospinal fluid was normal and sterile. Serous meningitis has, during the past few years, assumed epidemic proportions in Europe on several occasions. It has been suggested that this peculiar meningitic illness is an abortive form of poliomyelitis. The cases described occurred at a time when poliomyelitis had just begun to appear with some severity in many parts of London and this same synchronous epidemiology has been noted by others.

Schlesinger, Bernard, *Proc. Roy. Soc. Med., 26*: 145 (Dec.), 1932.

### The Treatment of Communicable Diseases in General Hospitals.

A discussion of this question at a recent hospital convention brought out the following considerations. (1) Lack of provision for the hospitalization of patients suffering from contagious diseases in many of the small communities of Canada. (2) Several difficulties lie in the way of local hospitals taking over the responsibility: (a) the treatment of communicable disease is a municipal responsibility, while the majority of the hospitals are under private management; (b) general patronage of the hospital might be affected and (c) legal responsibility in the event of the transmission of communicable disease to surgical and obstetrical patients.

A solution which has proved satisfactory is the provision of an annex for communicable diseases, the administration of which is assigned to the hospital superintendent who supplies nurses, while the medical direction is the responsibility of the medical officer of health. The cost of the unit is met by the communities concerned and where established has proved to be economical.

Hospital Service Department Notes, *Canad. M.A.J., 28*: 92 (Jan.), 1933.

### The Addition of Vitamin D Concentrate to Milk.

Milk is a logical medium in which to offer "vitamin D" to infants and children. As an alternative to the irradiation of milk, the addition of an anthracite concentrate from cod liver oil is suggested. For the purposes of study on a practical scale, one dairy has been licensed to prepare such a milk. The concentrate is furnished to the dairy as a "150 D" preparation which, when diluted 1 in 12,000 in the milk, furnishes the equivalent of three teaspoonfuls of cod liver oil per quart of milk. The incorporation of the concentrate may be carried out in three simple ways which do not require special equipment, and the concentrate does not separate from the cream. The taste of the milk is not affected. Studies of the effect of the milk on rachitic infants demonstrate its value and are being reported elsewhere.

Zucker, T. F., *Am. J. Pub. Health, 23*: 10 (Jan.), 1933.

### Study of Bacteriological Methods of Testing and Means of Disinfecting Water with Chlorine.

This paper has particular reference to swimming pool water. With chloramine treatment, and to a lesser degree with chlorine when the water is alkaline, germicidal action is delayed. Samples of swimming pool water collected during periods of use and immediately tested show more pollution than duplicate samples tested later in the usual way. Marked pollution as measured by colon bacilli and streptococci indices was found in swimming pool water in the presence of residual chlorine of 0.2 to 0.5 p.p.m., during periods of use. During periods of rest this pollution disappeared. A sodium thiosulphate treated bottle is recommended for collecting the samples. A small crystal of sodium thiosulphate or 0.5 cc. of a $\frac{N}{10}$ solution is placed in the bottle before sterilization.

Mallmann, W. L., and Cary, William, *Am. J. Pub. Health, 23*: 44 (Jan.), 1933.